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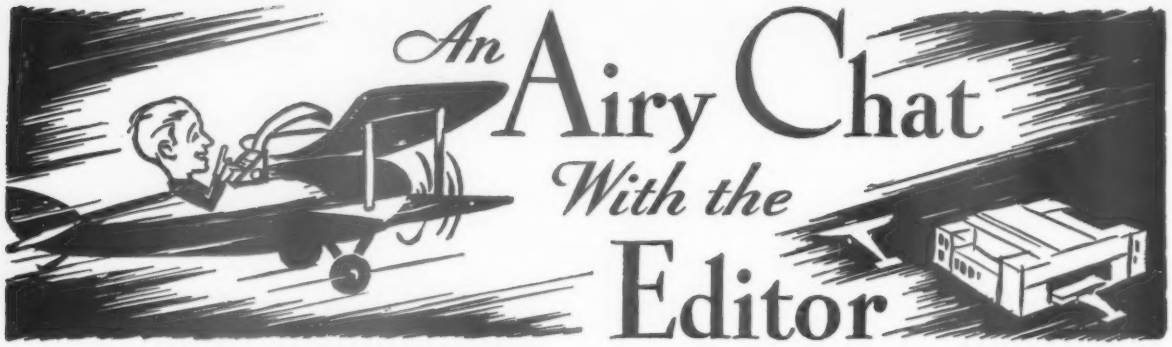

An Airy Chat With the Editor

THREE CHEERS for Capt. Albert W. Stevens and Capt. Anderson who reached well up into the stratosphere and broke the world's altitude record by a tentative altitude of 74,000 feet. These two men deserve every encomium that can be conferred upon them for their superb flight with the gigantic Balloon, "Explorer II."

A "shot" of 300,000 cubic feet of helium gas took them up where the barometric pressure dwindled down to 27.5 millimeters of mercury and where the spirits ran down in the thermometer to —78° F.

* * *

WE HAVE always been great admirers of Capt. Stevens, U. S. Army Air Corps, for his achievements in the science of photography and for his knowledge of aerostatics. His research into infra-red photography is epic. Our readers should recognize that this record breaking trip was a truly scientific expedition and not merely an attempt to go a few feet higher than someone else. Further, this sets forever to rest, the unofficial claim by Russia that the record was broken by them in 1934.

It should be understood, of course, that 74,000 feet may not be the exact altitude attained, for these readings were necessarily taken with an aneroid barometer and corrections must be made later by the Bureau of Standards before the exact altitude is known. However, we believe that the difference between the aneroid and the corrected value will be slight.

* * *

BUT, we beg to announce, that POPULAR AVIATION is sponsoring a scientific expedition itself. We have sponsored a weather seeking expedition under the direction of Selby Maxwell who, as this is being written, is travelling east to meet a severe storm in northern New York, a trip similar to the Florida trip described by him in the December issue of POPULAR AVIATION. Mr. Maxwell predicted this storm several weeks in advance of its predicted occurrence and we are only sorry that this issue goes to press before we can announce the final results of his calculations. However, the whole story, and a mighty interesting one, will appear in the February issue.

BAD WEATHER, as you know, is one of the few hazards now remaining to menace aerial navigation. It was, therefore, with great interest that we listened to Mr. Maxwell's explanation of his thoroughly scientific method of predicting storms and other weather conditions as far as twelve days in advance of their actual appearance, and resolved to thoroughly investigate this matter as our contribution to the safety of aviation and air-travel.

His logical analysis of the conditions that create storms, his 100 percent. success in predicting storms in the past, together with his systematic methods of conducting investigations, quickly won us over to himself and his methods and made us resolve to assist in carrying out a few practical experiments along the line of storm prediction under Mr. Maxwell's supervision.

Between the time that his article was published in the December issue and the time that this is being written, he followed up a predicted storm in northern Wisconsin with perfect accuracy and to our entire satisfaction. And we sincerely believe that the present expedition will be fully as satisfactory.

* * *

IF WE can help in the solution of the weather problem that has eternally threatened aviation, then we will feel contented with life. If we can advise airlines with unfailing accuracy, what the weather conditions will be at a certain time and place, far in advance of the actual occurrence of the conditions, then this will be a long sure step in the direction of safety that at present is unapproached by any other method now in use.

The airplane is more susceptible to meteorological disturbances than any other vehicle yet devised by man and, to be able to control this situation, so far as routing and dispatching is concerned, will go a long way toward reducing those discouraging headlines in the daily newspapers.

* * *

AND NOW, fellow amateurs, we have a big surprise for you. We have on hand, four excellent articles on how to build a hangar for $100—or less. The first of these articles appears in this issue and—like Ben Bernie—we hope that you will like it.

Most homebuilders have bumped up against the hangar and storage problem —and it has usually been a real problem that has discouraged many. After going through all of the agonies accompanying the construction of the plane itself and the painful experience of purchasing the motive power thereof, the financially decrepit builder has had still more grief ahead of him by the fruitless search for suitable storage near a suitable field at a suitable price. We trust and hope that the succeeding articles on amateur hangar building will prove of assistance.

* * *

GLIDING and soaring are undoubtedly on the upward trend. There is a surplus of prospective glider pilots and a distinct shortage of gliders. To Speed Westphal, we must give all credit for digging up this sport and bringing it into esteem once more among the readers of POPULAR AVIATION.

Gliding did not die—it simply "pulled in its neck" according to Speed's analysis, and now it is stretching out its neck once more for the favor of our lovers of outdoor sports. We hope that all this will fill our gliding slopes with enthusiastic and ambitious young men.

* * *

BY THE WAY, Speed Westphal has had his movie scenario accepted and purchased by a West Coast producer, and Speed is now in California, directing this film story. We hope that it brings him a million bucks.

* * *

WE HAVE always wondered why it is necessary for air-race fans to be profane and abusive in letters written in defense of their favorite sport. Out of the many letters received, protesting my recent article on the air-races, fully 90 percent. of them are unprintable. We like controversies and like to print the other fellow's views as well as our own, but this is impossible in the present case without getting into trouble with the Postoffice Department. We are printing, in the next issue, one of the very few printable letters that we have received in defense of air-racing.

* * *

EVENTUALLY, inventors find a use for everything. Gasoline used to be a pest at the oil refineries and now it is the leading item in their production. Spent hops used to be a problem around breweries but now is an important fer-

(*Continued on page* 54)

POPULAR AVIATION

Including SOUTHERN AVIATION and AERONAUTICS

A MAGAZINE FOR THE PROMOTION OF AMATEUR AVIATION AND PRIVATE FLYING

Volume XVIII JANUARY, 1936 Number 1

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Copyright, 1935
Aeronautical Publications, Inc.

POPULAR AVIATION, Volume 18, January, 1936. Published monthly by Aeronautical Publications, Inc., at 608 South Dearborn Street, Chicago, U. S. A. William B. Ziff, Publisher; B. G. Davis, Editor; John B. Rathbun, Managing Editor. New York Office, 551 Fifth Avenue, New York City. Subscription $2.50 per year, single copies, 25 cents, foreign postage, $1.00 per year extra. Contributors are especially advised to retain copy of their contributions, which must be accompanied by return postage. All such material will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Any copy accepted is subject to revision or changes to meet the requirements of this publication. Payment for copy used will be made at our current rates. Photos and drawings will be considered as constituting a part of the manuscript in making payment unless otherwise specified. Entered as second class matter, January 24, 1933, at the Post Office, Chicago, Ill., under the act of March 3, 1879.

XUM

The Physiology of Aviation

This is Capt. H. G. Armstrong in the altitude chamber, breathing oxygen through a mask while the thermometer at the left indicates a falling temperature. The cooling pipes are shown in the background, while another indicator shows the atmospheric rarity produced by the pump that is evacuating the chamber.

by CHARLES J. BAUER

IT is a new ship and a sweet one to fly and as the army test pilot lifts her off the ground, he turns in wide circles to gain altitude. She responds beautifully to every impulse, and on the climb upstairs the pilot puts her into sharp banks and short dives to get the feel of her.

Then, at 20,000 feet, he levels off and gives her the gun—150, 180, 200 miles an hour. A gentle pressure on the stick and the beautiful bird gathers momentum for the start of a test pilot's most critical experience—a power dive.

Down, down, down in a roaring crescendo she comes. The pilot feels his body lifted against the strap, the wind rushes past and the propeller bites great chunks out of the howling hurricane.

Ten seconds later, he begins to straighten her out. The plane, weighing 3,000 pounds, must be arrested entirely by the wings after it has gathered a momentum of perhaps "10g." or 30,000 pounds. The effect on the pilot is similar. Five seconds ago he was practically suspended in his seat; now he is crushed into it with terrific force. His weight of 165 pounds is multiplied tenfold and adds nearly a ton of pressure to the wing load. But the plane is built to stand it and comes out of the dive without injury.

The pilot is not so fortunate. The downward pull drains the blood from his brain. Everything goes black. Momentarily he is unconscious. The dive itself has made demands on his system and he has swallowed repeatedly to adjust the pressure inside his head to the increasing atmospheric pressure. But he recovers consciousness in time to level the ship out and land. The effect of power dives on pilots is one of the objects of research by a new unit of the air corps, recently organized at Wright Field, Dayton, for promoting the health and efficiency of army flyers.

A steep dive on a roller-coaster is a mild sample of what a pilot gets in a power dive. The coaster, as it starts up the next incline, bears down on the rails with many times its own weight, expressed by "g" for gravity. Pilots have been known to withstand a pressure as great as "12g." No wonder they sometimes "black out."

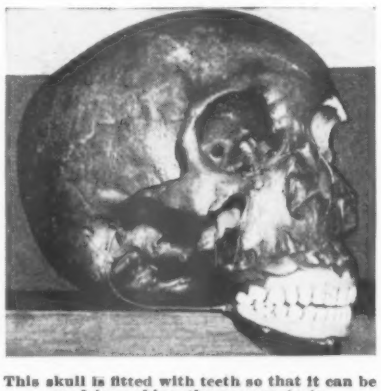
The rider of the roller coaster, of course, does not "black out," but he does feel his head snapped downward. He could not stand up at that point in the ride if he wanted to.

Under direction of Capt. Harry G. Armstrong, in charge of the new physiological unit, a whirling device or centrifuge has been constructed at Wright Field. The whirling portion is a welded frame of the same material as an airplane fuselage, with a pilot seat that runs on angle-irons from the axis to one end. The other end is weighted to balance the pilot. He sits sidewise, with his head toward the axis, and as the frame revolves in a horizontal plane, he is driven hard against his seat by centrifugal force.

Through power furnished by a motor, the centrifuge can be spun as much as 100 times a minute, fast enough to multiply the pilot's weight nearly by 100. Naturally no one could stand that force.

At slower speeds, the pilot chair is fastened near the axis. As the desired speed is reached the chair snaps to the end of its runway and the flyer receives the same pressure he gets in coming out of a power dive. When the centrifuge is stopped he may be found unconscious.

As the revolving speed is known, it is simple to compute the "g" force on the basis of the distance of the chair from the axis. Capt. Armstrong expects to determine the exact point at which the

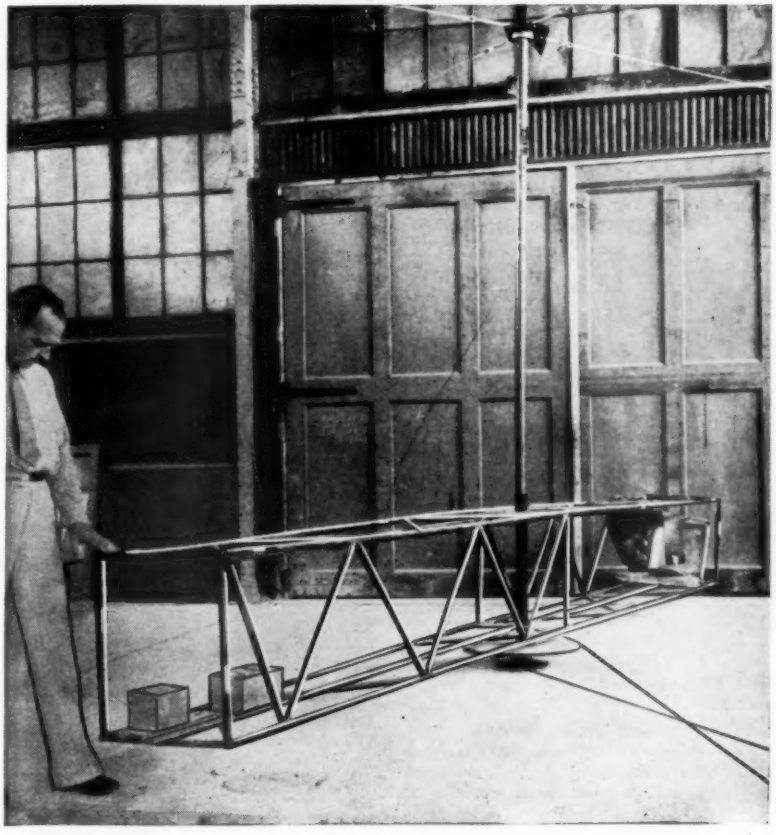


This skull is fitted with teeth so that it can be used in making the oxygen tests.

Now Studied at Wright Field

ULTIMATELY the horizontal or diving speed of a plane may be limited by the centrifugal force and its effect upon the body of the pilot. When we get above 300 m.p.h., pull-outs from dives or steep banked turns often drives the blood of the pilot out of the brain or works similar damage to his system.

Here, the author describes the interesting physiological experiments now being made at Wright Field by Capt. H. G. Armstrong on the various effects of flying upon the pilots of the U. S. Army Air Corps.



This is the new device, recently constructed at Wright Field, under the direction of Capt. H. G. Armstrong (left). This gives the pilots the same sensation as when they are being forced into their seats at the end of steep power dives or steep banks.

average pilot "blacks out" and perhaps establish a standard test to determine fitness for test dives. Experimenting with dogs, a German scientist found that small hemorrhages of the brain result, and perhaps the power diver pays some such penalty.

Power dives are more common in maneuvering naval craft. The navy has developed a diving technique for its bombers, on the premise that greater accuracy in hitting a moving mark is possible from low altitude, and the pilot can lift his craft into a sharp climb before the enemy unlimbers his anti-aircraft. The army air corps favors straight flying and use of bomb-sights, of which the United States has the most highly developed of any great power.

But a pilot is exposed to the same powerful centrifugal force in abrupt turns, such as rounding a pylon, as in a long dive. It is important to know the exact effect, so that equipment may be developed that will minimize the spine-crushing force. The new physiological unit has been located in the equipment branch for that reason. The next step may be perfection of a spring-suspended seat that absorbs the downward pressure, as a gun carriage is fashioned to take up the recoil.

Other possible changes in the pilot's equipment are envisioned by Captain Armstrong. In another five or 10 years, he believes, the complicated attire of army flyers at high altitudes will be as antiquated as the linen duster and goggles of early motoring. Airplanes, cutting a wide swath in the stratosphere, will demand sealed cockpits with air conditioning.

The skull is now hooked up to the oxygen tank with the pure oxygen gas to determine the effect of the gas on the teeth.

Flight at altitudes of 20,000 feet and even higher is on the increase and normal cross-country flying at high altitudes promises to become common, necessitating added oxygen. While aircraft designers and engineers have concentrated since the war on the problems involved in making airplanes speedier, more powerful and more deadly, the increased resulting hazards to the flyer himself have been sensed only vaguely.

Where the average pilot, for example, could fly a pursuit ship of several years ago at a speed of 120 miles an hour for several hours without exhaustion, the newest ships operate at double that speed or better, and increased ranges call for the endurance of eight or 10 hours' flying.

For years pilots complained occasionally of teeth breaking off or losing fillings after altitude flying with an oxygen mask, but for 15 years, since the medical research laboratory at Mineola, L. I., was discontinued, no work has been carried on by the air corps toward studying the changed effects of modern flying on health and human performance. The human element, a variable in any equation, must now be reckoned with scientifically.

Dr. E. C. Schneider's Long Island laboratory, which survived the war until 1920, was established for the purpose of ascertaining the effects of flight on personnel and of devising equipment to obviate those adverse to health and comfort. During the war the American pilot, for the first time generally, was subjected to flight at high altitudes. So new was this problem of oxygen control that it engrossed the attention of the researchers to the exclusion of nearly all else.

But by 1920 the emphasis had shifted so decidedly to aircraft development itself that Dr. Schneider's Medical Research laboratory was permitted to pass away.

In the interval since, material progress has accelerated. Speed has been

stepped up (and the end is not yet), with faster ships imposing new demands on men as well as materials. In both the commercial field and the military old standards quickly were replaced as governments lavished funds through subsidy and appropriation.

To normalize these trends to the well-being of the flyer is the task of the new unit. In this work it must go much farther than the air corps school of aviation medicine. The latter is actively researching, but principally along lines of occupational influences, illnesses and their cures. Except in the case of goggles, the school has had no tie-in with the equipment branch.

Captain Armstrong is qualified for his task of sharpening the spearhead in the new attack. Although one of the army's younger flight surgeons, he has studied medicine at the University of South Dakota and the University of Kentucky. It was while at the former that he heard the story of the half-breed Sioux whose skull is to figure in experiments to determine the precise conditions under which teeth deteriorate.

The doctor heard the story from an old westerner who had the skull in his possession. It seems that Lo, the poor Indian, or whatever his name, was attacked and left for dead, a tomahawk gash in his skull and his scalp dangling from an aborigine's loin cloth. The healed cleft in the skull attests the fact that Lo recovered to tell his children about the experience.

When Lo was gathered to his ancestors through natural causes, the skull came into possession of the westerner. So intrigued was he by the story that Dr. Armstrong hinted he would like to have the calcium souvenir. He has packed it with him since, little dreaming that he would have it fitted with a complete set of human teeth, cemented in their original positions.

Encased in a flying helmet and "breathing" through an oxygen mask, the skull will "fly" with Captain Armstrong in the altitude chamber at Wright Field, at various temperatures and degrees of oxygen saturation.

Research in this direction is having to start with fundamentals because of long neglect. What is the most favorable amount to be inhaled? Effect of frequent use for long periods? Degree of concentration at which it is poisonous or causes irritative pneumonia? Is liquid or gaseous form better?

The altitude chamber is a great ice-box from which any desired amount of air may be removed. This simulates conditions in the far upper atmosphere, bordering on the stratosphere.

This is Herman Gnau, demonstrating the position of the pilot in the whirl-test device. Mr. Gnau built the test equipment under the directions of Capt. Armstrong. Much data is being collected that will demonstrate the effect of the forces acting upon the body.

The effect of pure oxygen on the lungs is harmful. Tissues of the lungs may thicken and become congested, pneumonia resulting. Dr. Armstrong illustrates a tendency toward tissue oxidation by a simple experiment. Two cigarets are lighted and placed in an ash tray. Over one is passed a stream of pure oxygen. It flares up with almost explosive incandescence. The other cigaret glows normally.

Something similar, tests in the altitude chamber disclosed, happens to the lungs. Rabbits showed increased activity at first but under longer and more concentrated exposure they died.

Cold is a source of much discomfort to flyers and in an open cockpit tremendously handicaps a combatant's efficiency. Perhaps nothing has a more disintegrating effect on morale than the cold that bulky, electrically heated clothing cannot keep out. It is hoped to find a way of constructing open cockpits so that drafts from the floor or sides can be eliminated.

Moisture under masks and frosting of goggles also annoy Uncle Sam's air fighters. Solving the problem of drafts and heating cockpits would do away with these, as well as with the need of heated gloves that they say make for awkward handling of the craft and the guns.

Recent studies over continental United States show that the efficiency of the average pilot at temperatures prevailing two miles up is reduced 23 percent. A pilot suffering from cold has just one idea—to land as quickly as possible and get warm. Often he will not make his customary leisurely circle of the landing field, with a crack-up more likely.

The altitude chamber in which much of this research has been begun is the same used at Mineola during the war. Made of boiler plate, the compartment is heavily insulated with cork, is airtight, and painted with aluminum to exclude heat. An exaggerated air conditioning system permits temperatures simulating those at high altitudes, as low as —51°F. Air is exhausted by a suction pump to a rarity equivalent to that encountered at 40,000 feet, than which the unprotected human body can withstand no greater.

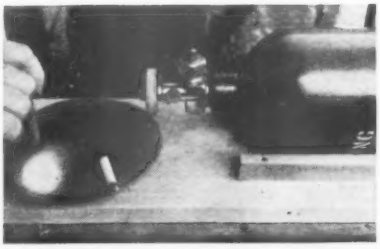
A study of the escape of carbon monoxide gas into cockpits also will be undertaken, to determine the increased amount of absorption into the blood at low temperatures and high altitudes, so that protective equipment may be developed.

Experience of stratosphere balloonists in air conditioning their gondolas may prove valuable in evolution of airtight cockpits, Dr. Armstrong believes. After all it is only a step from the stratosphere suit of Wiley Post—incidentally tested in the Wright Field altitude chamber—to an airtight cockpit.

The Italian Army have employed chambers of this type for some time in training their pilots. A new chamber is also being constructed in France.

And who knows? With such recent improvements as remotely controlled machine gun aiming and firing, and the possibility of flying a plane through electrical impulses from the pilot, instead of mechanically, the vision of sealed spherical cockpits in another decade does not seem fanciful.

END.



The stream of oxygen directed on the cigarette at the left causes it to burn with almost explosive violence. This is an exaggerated test showing the effect of oxygen on the lungs.

Fairchild—His Cameras and Planes

by ROBERT H. RANKIN

An intimate biography of an outstanding figure in the aviation world—still a young man but with years of accomplishment behind him.

BACK in the year 1918, a young inventor contacted the purchasing officers of the United States Army and tried to sell them the first practical aerial camera to ever be built.

The Army refused to pay any attention to the youth, but that did not discourage him in the least. With true Yankee brains and cleverness, he continued to develop his ideas and today the United States Army is buying almost all of their aerial cameras from that same man and, not only that, he is supplying the entire world with 80 percent. of the cameras used for aerial photography.

Let us look into the life of this man and see at first hand just how he began the development of his idea. Of course, you know his name—Sherman Mills Fairchild. He was born at Oneonta, New York, on April 7, 1896. His father controlled the International Business Machines Corporation, makers of time-recorders, tabulating machines, and other office equipment and, as a young boy, Sherman played and tinkered in the shops of the factory at Endicott, New York.

After completing his regular secondary education, young Fairchild went to the University of Arizona, then to the School of Engineering at Columbia University and then completed his formal education at Harvard. All during the time he was in college he tinkered and experimented with cameras and he continued his work after he left school, with the result that in 1918, at the age of 22, he completed a camera that made aerial photography possible.

One of the interesting features of the camera is the fact that, instead of being built up of wood as was the case with all the other cameras of that time, the Fairchild device was constructed of light weight metal parts, so standardized that they would be readily interchangeable. Perhaps the most important feature about the camera was its high-speed shutter which had been perfected by young Fairchild only after much experimenting.

At once, Fairchild tried to sell his device to the government, but for various reasons, best known to those who have had dealings with government, the sale was not consummated.

Some time later, Fairchild tried to sell twenty of his cameras to the Army Air Corps but the purchasing agent, a Capt. A. B. Nesbit, refused to pay the $40,000 which Fairchild asked for them. He explained that the purchases of airplanes had taken the greater part of the funds which had been appropriated for Air Corps purchases, consequently, he could pay but $1,800 each for cameras.

The Fairchild cameras were sold to the Army at that figure and later, when Fairchild learned that Capt. Nesbit had used the reverse argument in order to get the plane manufacturers to cut the price of their machines, he decided that a man with such bargaining ability would be of great value to him, so he hired Nesbit to become the Washington representative of the Fairchild interests.

In 1924, Fairchild decided that large scale aerial photography offered great possibilities, and so ordering two photography ships from the Huff-Daland people, he started a picture service for newspapers and magazines. At the same time, he obtained from Huff-Daland Company the sole sales rights for their photographic planes and, after considerable time, he sold two of the planes to the Brazilian government.

Sherman L. Fairchild, the subject of this biographical sketch, and the president of the manufacturing company bearing his name.

Upon presenting his order to the officials of the company he was informed that his contract with them had expired just four days before. At once he cabled the Brazilian officials that the planes they had ordered were unsatisfactory. Would they care to cancel that order and instead of those planes take delivery on two ships of a newer and better make?

In a very short time Brazil replied that the first order was canceled as far as she was concerned and delivery would be taken on the newer ships. Now young Fairchild was in a fix! He had an order for two airplanes, but he had no factory in which to build them.

Then he happened to think that out at Roosevelt Field, Igor Sikorsky, then an unknown Russian refugee and an airplane designer, loafed about jobless. Fairchild gave Sikorsky his first job in the American aeronautical industry and Sikorsky in turn designed the ships to fill Fairchild's order with Brazil.

During this same year, Fairchild decided that commercial aviation needed a practical cabin airplane. Both pilots and designers laughed at the idea. A cabin plane? Impossible! Why, every one knew that the windows would fog up and besides, a pilot just had to have the "feel" of the wind in his face.

Fairchild was sold on the idea, though, and he decided that if everyone else refused to build such a plane he would design and build one himself. He hired a hangar out at Farmingdale, Long Island, and started in the airplane manufacturing business, thus giving birth to the now famous Fairchild Aviation Corporation. Thus, Fairchild built his cabin monoplane and it was a decided success.

Since that time Fairchild's high-wing monoplanes have been used throughout the world for aerial photography, aerial prospecting, for freight carrying, and for mail and passenger transportation. Probably the most famous of the Fairchild ships is the monoplane "Stars and Stripes" which Byrd took with him on his first trip to the Antarctic. It was the first plane to be flown over those vast frozen wastes which surround the South Pole. When Byrd left the Antarctic, the ship was left behind and for five years it was buried in snow and ice. Then it was dug out of the ice and flown successfully by the second Byrd Antarctic Expedition and just recently it was purchased from Byrd to be used for a leisurely trip around the world.

The two most recent planes designed and built by the Fairchild concern are the "Baby Clipper" amphibian, and the Fairchild "45." The "45" is designed, specifically, to meet the growing demand for an airplane of medium size which will serve as the aerial counterpart of the modern streamlined automobile to which the average person has become so accustomed for business and pleasure use.

It is a high speed low-wing monoplane with a cabin which provides the comfort and general arrangements and appointments of a first-class five-passenger automobile sedan. The ship is powered with a 225 h.p. Jacobs air-cooled engine, has a top speed of 160 m.p.h. and a cruising speed of 147 m.p.h. The cruising range of the ship is 600 miles.

The Fairchild "Baby Clipper" is the world's largest and fastest single engine amphibian transport. Six of these ships are being built to the specifications laid down by the engineers of the Pan American Airways and they are to be used along the river routes of the Pan American system and on such other routes where the flexibility of an amphibian type ship is desired.

The ship carries two pilots, eight passengers and 1,000 pounds of mail and

The popular Fairchild "22" cabin job so popular with the aero-sportsmen.

express at a cruising speed of 158 m.p.h. with a top speed of 179 m.p.h. The range of the plane is 750 miles. The cabin of the "Baby Clipper" is 16-feet long and 6-feet high and has two compartments accommodating four persons, each in comfortable lounging chairs. Large windows and the high position of the monoplane wing afford an exceptional range of view for both passengers and crew.

Among the planes being produced by the Fairchild concern at the present time are the Fairchild "22," a two-place, open-cockpit, parasol type monoplane, and the Fairchild "24," a full cabin, high-wing monoplane job. It is most interesting to note that in the short span of three years the Fairchild Aviation Corporation has moved from the twenty-sixth to first place in the private plane production field.

Closely allied with the Fairchild Aviation Corporation are three subsidiary concerns; the Fairchild Aerial Camera Corporation, Fairchild Aerial Surveys, Inc., and the Fairchild Aircraft Corporation, and although these four concerns together employ some 780 men, they are under the leadership and control of one man—Sherman Mills Fairchild, founder and president.

As a result of a $185,000 contract awarded them by the Soil Conservation Service, Department of Agriculture, the Fairchild Aerial Surveys during the closing days of last July began the making of a detailed topographical map of central New Mexico. From information gleaned from this map, soil erosion engineers will attempt to find ways and means of keeping the vast areas of the Southwest from becoming another Sahara Desert.

Incidentally, this survey is the most ambitious aerial mapping project ever undertaken in America, and it will provide maps of more than 50,736,000 acres of the Rio Grande River basin and adjacent territory. For this particular mapping job the new $26,000 Fairchild nine lens camera will be used. This camera is the most expensive ever built and at an altitude of 30,000 feet it will "shoot" 760 square miles with one shutter click.

The Fairchild Aerial Surveys have just completed photographing the entire state of Connecticut from the air. The survey was contracted for by the state to facilitate the administration of the various departments of both the state and local governments as well as to provide modern, up-to-date photographs for the use of business and industrial concerns and the general public.

The photographs have been filed in the State Library at Hartford, where they are at the disposal of the public. This is the first time that a photographic survey of an entire state, contracted for by a state and made available as a state service to the general public as well as for the use of state and local authorities, has ever been made. The first state to be completely airmapped—Massachusetts—was photographed in 1933 with the aid of a multi-lens camera under the auspices of the Institute of Geographical Exploration of Harvard University.

(*Concluded on page* 64)

A five-place Fairchild "45" plane equipped with a Jacobs 225 horsepower engine.

Air Service in the Philippines

AN airline, which has been in existence four years, has a record of 550,000 miles flown, 5,000 hours in the air and has carried 10,000 passengers without an accident is the Philippine Aerial Taxi company, which operates a daily mail and passenger service between Manila and Baguio, high in the mountains 130 miles to the north.

This pioneer aviation company of the Philippine Islands, flies planes on a 55-minute schedule between the two cities. It has failed to get the mails into Baguio only twice in the last two years. Both times during the typhoon season. The company has three pilots, all Americans holding American flying licenses. Bellanca Skyrockets are used. They are cabin ships able to carry five passengers and a pilot and are powered with Pratt & Whitney 450-horsepower Wasps.

Communication between Manila and Baguio was difficult before the day of the airplane. When William Howard Taft was governor general of the Philippines it took him three days to make the journey. He cabled this fact to Elihu Root, noted American statesman, and received the famous reply, "Congratulations. How is the horse?"

Bombing Planes Come High

HERE we have the authentic quotations on bombing planes for the U. S. Army Air Corps. These bombers were entered in the 1935 bomber contest and the prices quoted below are the prices per plane in lots of 25 or 220 planes. It pays to buy them in bunches as you will readily see.

Name of bomber	In lots of 25	In lots of 220
Boeing bomber	$196,730	$99,620
Martin bomber.....	85,910	48,880
Douglas bomber.....	99,150	58,500

The prices sure come down when the experimental and development charges are written off against a number of machines. It is said that the first Boeing "299" cost about $500,000 but this is cut down to one-fifth the value of the first ship when a flock of 220 are ordered.

Safe-Guarding Propellers

THE recent death of the stewardess who walked into the whirling propeller, brings home the sad fact that the props of planes at rest on the ground are not as well guarded as the machine gears in the most primitive factory. Here's something for the Bureau of Air Commerce to take up.

To provide a propeller with a guard, similar to that used on electric fans, would undoubtedly introduce a great resistance on fast traveling planes and, for this reason, is probably impracticable on all but the slowest lightplanes.

The final solution, in our minds, that will eventually come about, is to employ propellers of the small diameter encased turbine type which has been advised by J. B. R. for the past ten years.

Beware of the Anti-Aircraft

by ALLEN GEORGE

Year by year, the anti-aircraft division of the U. S. Army is improving its effectiveness until it is now a direct challenge to the air-forces of the world.

AIRPLANE manufacturers and builders of military airplanes, have made great progress in the performance of their planes. The military planes fly high and fast, but—

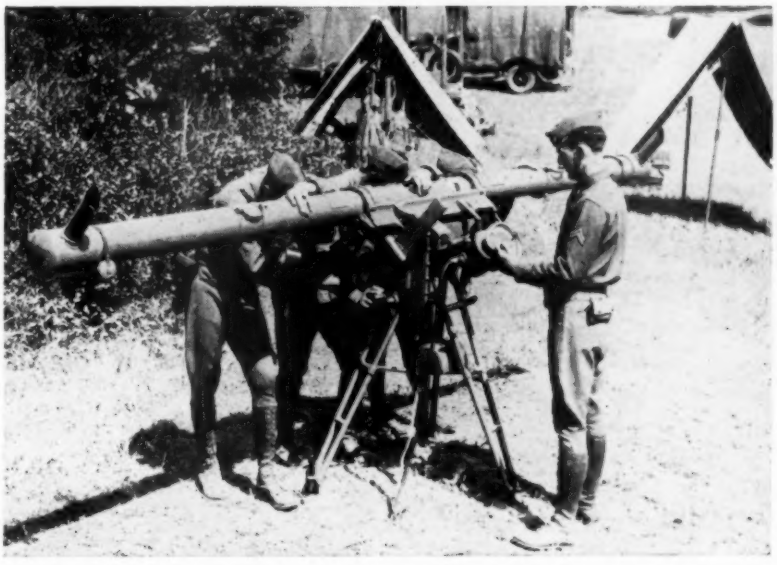
On the ground is a unit of which the public hears but little and which is rapidly proving a match for the fastest highest flying planes. This enemy to aircraft is the anti-aircraft battery which has been raised to a high degree of precision since the war. As a matter of fact, the precision of fire from the ground is such that the anti-aircraft batteries make air raids a very hazardous proceeding.

Accurate range-finders, sound-locators and searchlights have taken the guesswork out of anti-aircraft fire to such an extent, that direct hits on the target are becoming more and more frequent in practice. The way matters stand at present, invading aircraft must keep well above 20,000 feet elevation to avoid the shell sent up by the batteries and, at this elevation, the airplanes lose maneuverability to a marked extent so that the bombers find it far more difficult to lay their "eggs" on the desired target. Night is no longer a cover for bombing raids nor can clouds effectively screen the squadrons.

In general, there are three methods of locating aircraft above a city. In the daytime, by direct sight or by sound, both devices being interconnected with distance measuring instruments known as "range-finders". At night, the searchlights provide the necessary illumination for the range-finders, assisted by the sound-locators. Once the ship is located, it is a simple matter for the guns to send their shell on or very close to the target.

Unfortunately, for the airplane, it is practically impossible to suppress the sound of the engine exhaust and the whirr of the propellers, hence this sound has also been made a means for locating the general position of the plane from the ground. While it is usually quite difficult to pick up a plane by sight or by glasses in the daytime, or by searchlights at night, the sound of the plane in the receivers of the sound-locators makes it an easy matter to estimate the approximate position. Knowing the approximate position narrows down the area to be searched so that the range-finders can be brought into action quickly.

The sound-locators, basically, consist of trumpet shaped receivers that receive sound at a maximum when pointed directly toward the source of the sound. Microphones in the base of the trumpet amplify the faintest sounds to a great volume so that the general direction of the plane can be determined at a comparatively great distance. The search must be made as rapidly as possible because the planes move at high speed and may reach their objective before the guns can be brought into bearing if their is any delay in the sound location.



This odd looking device is the stereoscopic range-finder by which the exact position of an invading airplane is located. This is an apparatus of great precision which gives accurate firing data to the guns of the battery.

Here we see the sound-locators and the searchlights of the 62nd Coast artillery being used in field practice. The sound locators are in the foreground.

An anti-aircraft gun at the instant of firing. The fire is controlled by the combined efforts of the range-finders, sound-locators and searchlights. It is this type of gun that places enemy aircraft on a very hazardous basis.

Aerial Photography and Its

by HARRY A. WHITE

Courtesy U. S. Army Air Corps

A camera class in session at Chanute Field, Rantoul, Ill. In the background will be seen a portion of the tremendous mosaic of the City of Chicago which shows every street and every building in full detail.

WHEN man first zoomed into the air and found he could keep on zooming, he naturally wanted to have some means for permanently recording the marvelous panorama his eyes beheld.

Pen or verbal descriptions failed to describe. Imagination alone could picture the world below as seen by the airman and few cared to exercise that mental function, their interests being centered on the wonders of flying itself and the manipulation of the controls.

Then, someone with curiosity above the average, decided "out of curiosity," to see if by taking an ordinary camera aloft and "snapping it" over the side of the fuselage, he could get a picture of the ground below to show as a novelty to his friends.

One can picture this first "aerial photographer" developing those films in the recesses of his dark room, waiting with suppressed excitement to see what sort of picture he would bring out and then his whoop of surprise as he studied the strange results on the negative before him.

While he knew the country by heart, every road, turn and fence post, as well as the barns, houses and churches, they never "looked that way" in real life. Here was a new dimension, a new way of looking at things, things that were older than the instrument which made it possible. And so, we believe, aerial photography was born.

Then came the great war with its sudden and impetuous demand for planes and men to fly them and to the army Intelligence Department, the realization that pictures should be taken of the enemy positions and gun displacements, of the terrain to be fought over, of the miles of trenches and barbed-wire entanglements, not to mention troop and transport movements, it would be possible to arrange surprise attacks at vital points by securing advance information of the enemy's plans.

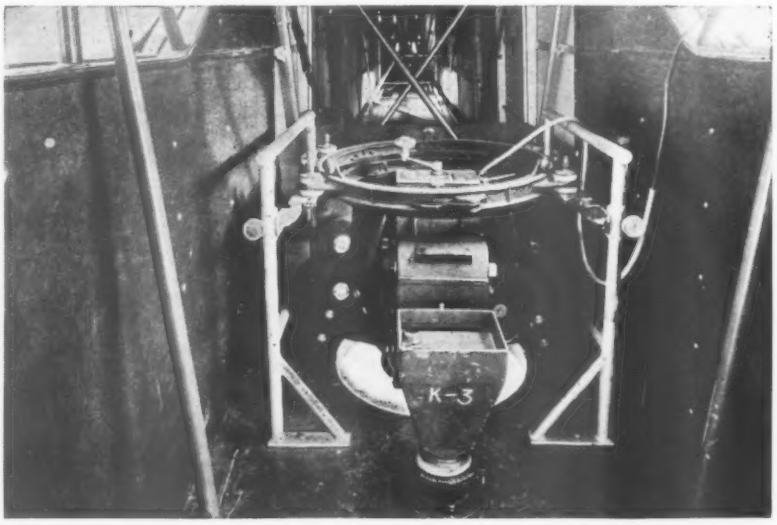
Capt. G. W. Goddard, U. S. Army Air Corps, ready for a little spin into the stratosphere.

But the cameras of war days were not the cameras of today and, although fast work was done in developing the photographic art, the problems with which the early photographers were faced were so new and radically different, that it is surprising the rapidity with which progress was actually made.

Taking pictures from the air meant taking them under entirely different conditions from that obtained on the ground below. Not only were weather conditions to be surmounted, but the intense cold at high altitudes required the heating of cameras as well as films to prevent them cracking. And, further, when plates were used, the very weight of the loaded camera was a serious problem.

Then, in the development of the aerial camera, they had to reckon with a human factor limiting visibility to one thousand feet altitude and about one hundred thirty miles to the horizon, when compared with six or seven miles on the ground. Average eyesight encompassed eighty to one hundred square miles on the ground in contrast to about fifty thousand square miles at ten thousand feet.

But even under those difficulties, plus



Courtesy U. S. Army Air Corps

Looking down the long funnel of an army fuselage with the camera shown mounted in gimbol rings, in appearance, much like a scarff ring. The lenses, of course, point down.

Importance in Peace and War

FOR their kind assistance in the preparation of this article, we wish to thank Brig. Gen. H. H. Arnold and photographic officer Capt. G. W. Goddard, both of the U. S. Army Air Corps, Chanute Field, Ill.

These officers are to be greatly complimented upon the effectiveness and efficiency of the training at Chanute Field which is the outstanding technical school in the United States, whether it be a civilian or military school. We have been in contact, from time to time, with many graduates of Chanute Field who praise the training and methods enthusiastically.

Courtesy U. S. Army Air Corps

A class in mosaic map making at Chanute Field, one of the most interesting and intricate branches of photography, but of prime importance during wartimes, as well as in times of peace.

that of focusing from a high altitude and from a moving body going at the rate of a hundred or more miles per hour, thousands and thousands of pictures were taken, mostly "spots" or "pinpoints" of single objects. These, when used as control-points and definitely located in their relation to other known points by triangulation, served to direct gun fire and otherwise provide assistance in the plans for attack or defense.

During the war, all photographs were made during the daylight hours if weather conditions permitted. Usually, the hours between eight in the morning and four in the afternoon were all that permitted picture taking by natural light. Most of the cameras were carried in the hand and, either aimed over the side of a low flying plane to obtain "obliques," or else focused vertically through holes in the floor of the plane for taking "spots" or "pinpoint" negatives.

With the ending of the war, the possibilities of aerial photography in civil life began to be realized and the laboratories of great camera manufacturers like the Eastman Kodak Company and the Fairchild Camera Company began extensive, as well as expensive, experiments in developing apparatus of greater radius and efficiency as well as the films and emulsions to go with them.

Although aerial photography, as yet, is not the pastime of amateurs nor of those with slim pocketbooks, the remarkable results which have been achieved by the firms equipped to enter this field from a commercial standpoint, not to mention the strides forward which have been accomplished by the aerial photographic branch of the Army Air Corps, should prove of interest to the general public.

Saving time, as well as money, has been the objective of commercial aerial photography. By its use, especially in the making of aerial surveys, it is now possible to survey and map in a few hours areas which, if surveyed and mapped by the old time ground methods, would take not only days but months to accomplish.

Mr. Robert Shippe, president of Aerial Explorations, a company making a specialty of aerial surveys for scientific purposes, says: "Three and one-half hours of flying accomplished more than could be done by a land-party of six surveyors working two years." Depending upon whether single or multi-lensed cameras are used, a territory ranging from two hundred to two thousand square miles may be surveyed and photographed in one day.

Indeed, it is now possible for twelve airplanes, properly spaced and flying at an altitude of twenty-five thousand feet, to photograph the entire state of Illinois in seven and one-half hours. And, as you can learn by consulting your geography, the state of Illinois is 350 miles long and 150 miles wide.

Commercial firms, specializing in aerial photography, can almost be numbered on the fingers of one hand, and although remarkable progress has been made and worthwhile work done in the matter of securing aerial views of real estate developments, the location of traffic jams from the air, the mapping of ancient civilizations and other scientific work, the profession is still in its infancy notwithstanding the fact that the news-

Courtesy U. S. Army Air Corps

A marvel of aerial photography. An infra-red ray photograph taken at an elevation of 25,000 feet and showing mountain peaks 250 miles distant. The infra-red rays pierce the haze and fog for great distances.

camera man has given to the press and public many odd shots of out-of-the-way places.

To really appreciate the progress made in aerial photography, one must turn to the army where aerial photography is a very special and important branch of the Air Corps activities. In order to gather information on the progress being made by the army, the writer recently visited Chanute Field, the U. S. Army Aviation Ground School, Rantoul, Illinois. Through the courtesy of Col. Junius W. Jones, the Commanding Officer, he was permitted to spend several hours with Captain G. W. Goddard, considered one of the two leading aces of the army in airplane photography.

"People often wonder," said Capt. Goddard, "why the army needs and uses so many different kinds and sizes of cameras. The answer is, each camera is really the best one for the work it is designed to do. That is why you will find us using cameras with focal lengths ranging from eight and one-half inches to as high as forty-eight inches."

As the captain further explained, if one is flying sixteen thousand feet up and wants to photograph the area directly beneath him, a camera with a focal length of eight and one-half inches is sufficient. But, when one is flying at an elevation of twenty-five thousand feet, along a coast-line and wants to catch a fleet at sea fifty or more miles out a long focus camera up to forty-eight inches is best.

Before the advent of the modern supersensitive films, the weather and light were everything in taking pictures from the air, but today pictures can be taken twenty-four hours each day if necessary.

Between the earth and an altitude of sixteen thousand feet, as a rule, one finds the air permeated with a haze and pictures taken through this haze with ordinary films show up cloudy or indistinctly instead of sharp and clear with full detail. To penetrate this haze, which really consists of tiny droplets of moisture which catch the sun's rays and reflect them back into the camera lens, modern photography resorts to the use of invisible infra-red light with infra-red filters which not only penetrate this haze but permit the taking of pictures which are out of the range of the human eye. The infra-red rays permit the taking of long distance pictures up to points several hundred miles distant, as shown in the accompanying illustration, taken from a twenty-five thousand foot elevation.

One of the major problems of aerial photography is map making and at Chanute Field a separate room is set aside for the building of maps, or "mosaics" as they are technically called, which are really quite complicated affairs. The assembling of the mosaics requires not only good eyesight but trained drafting skill as well as a knowledge of mathematics.

In mapping with a single lens camera, the plane must be held at a definite altitude and flown in a uniform straight line. As a rule, a definite point or landmark, such as a church or other building, is selected as a control-point from which the survey is to begin. On the ground-glass or finder of the camera, we find a number of vertical etched lines and when the control point shows up on one of these lines, the problem of the pilot is to keep the object on the ground below always on the same line in the finder.

In the interests of accuracy, each photograph taken on a continuous flight is overlapped by sixty percent. of the adjacent and succeeding picture. When a plane turns parallel to the course it has first flown, there is a side overlap of fifty percent. in addition to the sixty percent. lengthwise overlap, therefore making only twenty percent. of each vertical photograph taken available for use.

When an airplane flies over land which has no distinguishing landmarks, such as swamps, shorelines or sand deserts (from which bearings can be taken), it is necessary to take compass bearings which, when used as guides for aerial surveying, requires extreme accuracy.

The modern camera for work of this kind is mounted on gimbol mounts which permits the camera to swing. Then, with the aid of a spirit-level, the operator can keep the camera vertical even though the plane itself tips slightly out of line in flying. The camera, of course, is focused through a hole in the floor of the fuselage.

Making mosaics from pictures taken with single lens cameras requires a considerable length of time and patience. Therefore, to reduce this work to a minimum, as well as to cover a much broader area in each picture, the multi-lensed camera was perfected.

With this camera, it is now possible to take five pictures or "exposures" simultaneously, which means fewer shots to cover the required area. By using a

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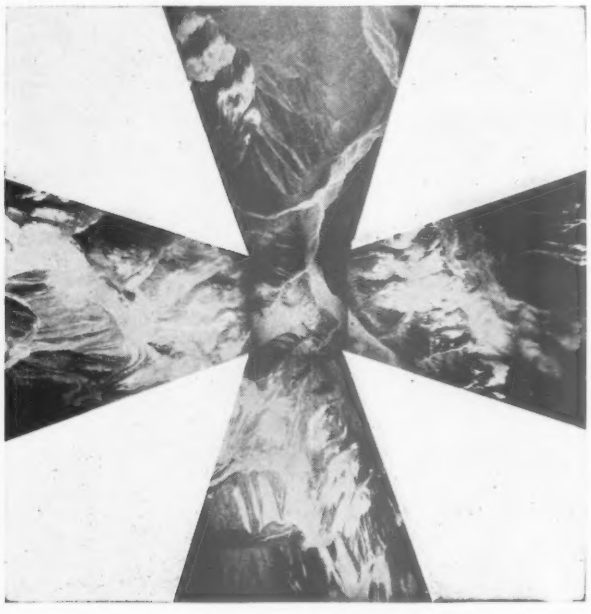
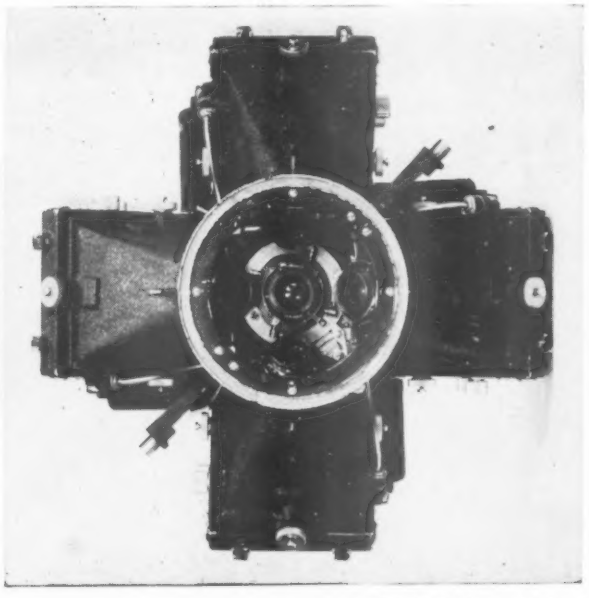


Courtesy U. S. Army Air Corps

A photo taken of the Alaskan Project with the five-lens camera by Capt. G. W. Goddard, July, 1934. This maltese cross, taken at an elevation of 16,000 feet, shows the part taken by each of the five lenses. Later, photos from a four-lens camera, fit into the blank spaces between the arms.



Courtesy U. S. Army Air Corps

A Kodak fiend's dream. The five-lens camera employed in the making of mosaics. And what a lot of territory she can shoot at one time! The photograph taken by this camera is adjacent to this illustration.

The Vultee Attack Plane

by ROBERT McLARREN

A detailed description of the new Vultee Attack plane which has attracted a great deal of interest in military aviation circles. Attack aviation is rapidly coming to the front.

THE new Vultee attack monoplane has proven highly successful in tests at Grand Central Air Terminal, Glendale, California.

Its performance is much better than the designers expected, having shown a top speed far in excess of any attack plane now in use by any nation. This new innovation in attack planes is manufactured by the Airplane Development Corporation, Glendale, California, a Cord subsidiary. It was designed and its construction supervised by Gerald Vultee, the well known engineer.

This new design is a result of the wide experience gained by this organization with their ten-passenger transport, the Vultee V-1A. The tremendously speedy ship is now in service on several of the nation's air lines. With Jimmie Doolittle at the controls it recently set the transcontinental transport speed record which was a few days later broken by Leland S. Andrews in the same ship with a time of 11 hours, 34 minutes, and 16 seconds.

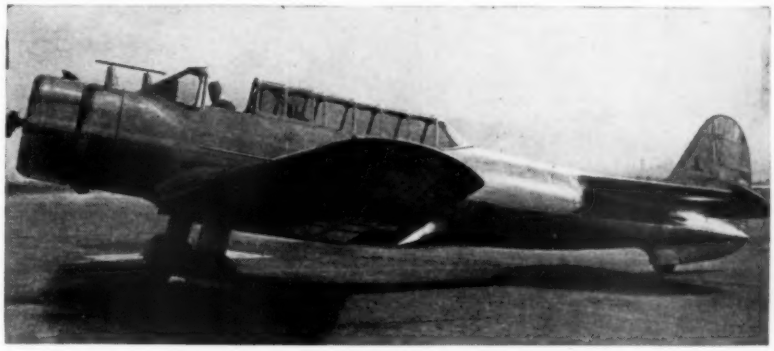
Unfortunately, the first ship of this new attack series crashed, killing its pilot, T. C. Van Stone, and Dugald L. Blue, project engineer of the company. The engine cut out on a takeoff and, rather than run the risk of a collision with the high tension wires directly in his path, Van Stone attempted to bank and return to the field.

The inevitable side-slip resulted and the plane crashed, killing its occupants. Obviously, the design or construction of the plane was not at fault, although the engine failure is still being investigated. It is a result of this accident that the airports of Southern California and the nation have started campaigns for the removal of high tension wires near the boundaries of air fields.

The second ship has just been completed and more extensive testing of this design has been made possible. It has shown a cruising speed of 220 miles per hour and a top speed of 245 miles per hour, remarkable performance for a military type aircraft.

It climbs to 20,000 feet in 14 minutes, operates at a service ceiling of 27,000 feet and can climb to 29,500 feet, its absolute ceiling. Obviously, it is not a low altitude fighter as are most attack planes.

This speedy two-seater is powered with the new Wright "Cyclone" model SR-1820-F53, which delivers 750 horsepower at 16,000 feet. With the exceptions of the aileron and elevator surfaces, all metal construction has been employed throughout. These controls surfaces are of metal construction fabric covered which makes them lighter and consequently easier to operate. The regular single beam Vultee retractable landing gear is employed.



A side elevation of the Vultee Attack plane showing its clean speedy lines.

A metal covering has been geared to close over the wheels while in the retracted position, thus presenting an absolutely smooth under surface to the slipstream. Two types of warnings have been used to indicate the position of the gear. A red light on the instrument panel as well as an electric buzzer warn the pilot that his gear is still in the retracted position.

A 360 degree rotation tail wheel is completely enclosed in a streamlined housing which has been faired into the rudder. The stabilizer and elevator group have been raised considerably. This surface now rests on the top of the fuselage completely forward of the rudder post and directly in line with the rear gunner. This gives him a greater vertical range of fire. Lugs on the gun ring prevent his firing into the tail surfaces.

The armament consists of four Browning electrically controlled machine guns firing forward. These are in groups of two in each wing firing outside the propeller arc. This eliminates the extra weight of complicated synchronizing mechanism. The rear gunner is equipped with either one or two guns mounted on a specially designed gun ring.

The supporting members of the gun ring have been welded to the gunner's seat. He has but to twirl his seat to the left, right, up, or down and his weapons are in the desired position. The pilot sits high and well forward in the cabin. He is equipped with a very complete set of flight instruments arranged in the familiar Vultee three-panel instrument board.

A gunsight is mounted along the forward cowling on a level with the pilot's head. A strong metal tripod has been constructed immediately to the rear of the pilot's head within the cabin. This prevents any damage in the case of a nose-over in landing.

Wings are of dural construction all bending and shear loads being taken up by the Alclad covering. A composite wing construction is employed. An inner corrugated strip runs from the center section to the tips, joining on each side the leading and trailing edge members. This is then covered with 24ST Alclad.

The span consists of three sections, a center section built integral with the fuselage and two wing panels bolted to the stub. The ailerons are statically balanced along their hinge axis and are fabric covered. The landing flaps are of metal and are operated by small, parallel turn pulleys. The section to the rear of each landing wheel is rubber covered to prevent damage to the flaps while taxiing in the "down" position. The wing stubs have been streamlined into the fuselage with large Alclad strips.

All controls are equipped with "tabs," adjustable while in flight from the cockpit, to offset propeller torque or possible wing heaviness. A bullet proof glass composition has been employed throughout the construction of the sliding hatches. These consist of only two movable parts each including three glass panels.

The pilot's hatch moves to the rear over the stationary center section, the rear gunners moving forward under the center section. The rearmost panel can be raised or lowered and locked in any of three positions to permit the exposure of the gunner's weapons.

It would be interesting to know just how much this rectangular formed hatch increases the resistance of an otherwise nicely streamlined body.

The first ship of this design was to have been delivered to China and the second to a South American republic. However, due to the crash of the first, the second is now en route to China and a third ship is now under construction for South America. China has already placed an order for eight of these attack ships and a much larger order is expected soon.

XUM

A Page of Rare Warplane Photos

OUR Photo Phans will welcome these rare photographs of three prominent World War planes which, by the way, are from the collection of Jack W. Brant. The photographs are not only unusual, but notable for their clarity and the amount of detail shown.

If the fellows of the present day do not believe that they understood streamlining in 1918, just let him cast his gaze on the Morane-Saulnier XXI at the head of the column. Or, let him look at the next picture of the Roland. Both of these ships are as clean and trim as the most modern of planes and, considering the limited power, gave a fine performance.

But the cream of the collection is the little Nieuport XI, just as she appeared in her earliest childhood, or in her test-hopping days. She is so fresh from the drafting room that she has no insignia nor identification marks of any sort. It was this model of which a celebrated pilot remarked, "thin as a lath and light enough so that you can spit through her anywhere." How this frail assemblage of kite-sticks and linen managed to fly out and then come back is a mystery.

The streamlining of the Morane-Saulnier is fascinating, starting with the smooth flowing lines of the spinner and cowl that pass smoothly into the finely tapering rear portion of the fuselage. The only break in the line is the lamentably large gap left for the double cockpit.

The side view of the Roland also displays the same continuity of outline from nose to tail, somewhat obstructed by the engine in the nose, but better in the neighborhood of the cockpit.

This beautiful Morane-Saulnier XXI was the inspiration for many of our lightplane builders.

The Roland came too late in the war to demonstrate much except its high speed and maneuverability.

Here we have a very early model of the Nieuport II, when in its test-hopping stages. Paris will be seen in the background.

Reviews Command From Plane

MAJ. GEN. HUGH A. DRUM, commander of the Hawaiian department, recently reviewed the Eighteenth Composite Wing high over Waikiki Beach while flying in his command plane. Seventy-five planes of the Hawaiian department's air force dipped in salute. In the past officers of the Air Corps have reviewed their units in the air, but Gen. Drum is thought to be the first non-flying department commander to conduct such a ceremony.

Aviation Insurance Company Formed

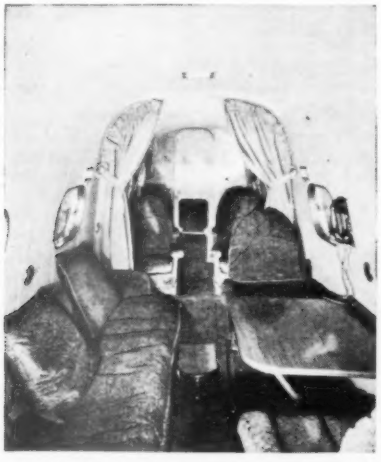
THE aviation industry has assumed a position of growing importance with the insurance companies. In Great Britain, twelve leading London insurance firms and two brokerage houses have formed a company to specialize in risks associated with aviation. It is known as Aviation and General Insurance Co., Ltd., and has a capital of $2,500,000.

The Phillips Petroleum Club Plane

PHILLIPS PETROLEUM COMPANY, noted for its great interest in aviation, has just taken delivery on a new Boeing 247-D transport which is to be used by the executives of that company on business trips.

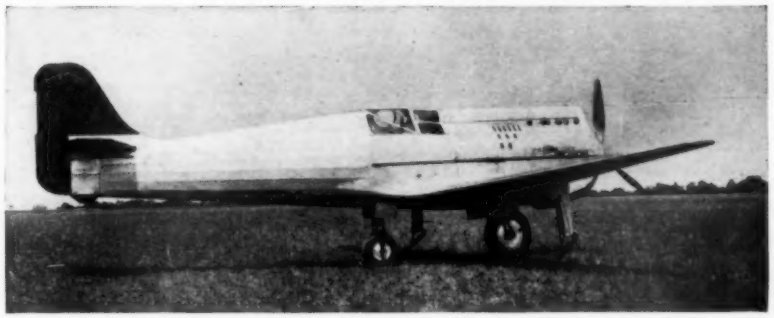
It is said to be the most luxurious plane ever built for this purpose. It has many de luxe appointments which include overstuffed easy chairs, a divan, table, refrigerator, walnut cabinets and a built-in radio for the reception of broadcast programs. A second radio system is also installed for communications between the ship and ground.

The flying club car is powered with Wasp engines and attains a top speed of 202 miles per hour.



The interior of the Phillips Petroleum Club car shows a surprising amount of space and ample provision for the comfort of the officials.

A Flying Landing-Gear Laboratory

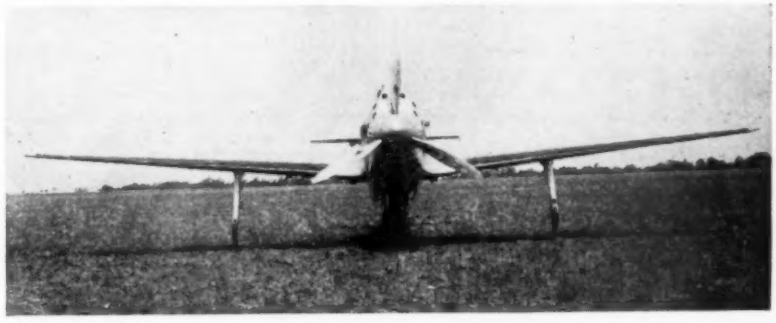


Side view of the Messier monoplane showing how the landing-gear wheels are arranged in tandem.

GEORGES MESSIER, a French experimenter, has recently constructed a test-plane for trying out the utility of the tandem landing gear arrangement shown here. The purpose of the tandem arrangement is to more completely control the take-off course of the plane, particularly in side-gusts, and to reduce the fore-and-aft oscillations that take place when running over the ground. Again, the tendency toward nosing over is greatly reduced when the brakes are applied.

The landing-gear is of the hydraulic type, operated by an engine driven oil-pump, and retracts automatically without effort by the pilot when the plane leaves the ground. In retracting, the appliance compresses air and stores the air which is then utilized for extending the landing gear when approaching a landing. In this way, the stored compressed air will open the landing gear with certainty even when engine and oil-pump have stopped.

When standing upon the ground, as shown in the front view, the ship is held in position by two skids extending from the wings. When up to fair speed, these wing skids retract into the wings so that they present no resistance in flight.



Front view of the Georges Messier monoplane, showing the peculiar arrangement of the retractable landing-gear.

Inflating a Balloon Takes Careful Attention

IN reply to the requests of numerous readers, asking how a balloon is filled or "inflated," we show the accompanying photo of the Polish racing balloon "on the hose."

The bag or envelope is first spread as flat as possible upon the ground, to exclude the air, and then the hydrogen gas from a multitude of steel cylinders passes into the bag through a large manifold. The outer circumference is weighted with sandbags to give the proper distribution of tension, and the sandbag lines are let out little by little as the inflation proceeds.

The accompanying photo shows the Polish balloon about three-quarter filled, but the ring of sandbags and the lines are still in place around the balloon.

Inflation of the Polish balloon.

A Sailplane With a Retractable Engine

by PIERRE MARIE, European Correspondent

Here is the Carden-Baynes sailplane with the auxiliary engine in position for propelling the glider. Note the extremely small dimensions of the power-plant.

GLIDING is rapidly gaining favor in England and among the many interesting developments is the Carden-Baynes Auxiliary soaring plant which carries a diminutive power-plant, which in this country, would probably be known as a "glide-stretcher." It should be borne in mind, however, that the principal function of this ship is soaring and that the engine is really an auxiliary.

This craft, the invention of Sir John V. Carden and designed and built by M. E. Baynes, has an inverted single-cylinder Carden-Villiers engine which can be retracted within the structure while soaring and ex-tracted (pardon the homemade word) when power is required as a means for taking off or gaining the initial height necessary for "thermal" or cloud-hopping. When a sufficient height has been attained, about 5,000 feet, the power-plant is retracted, thus giving an efficient high-performance sailplane. The engine is of the two-cycle type with a displacement of 250 c.c.

This greatly simplifies the problem of soaring at many airports located on flat level ground, as it is independent of wind direction to a great extent. It is no longer necessary to search out special sites for soaring as has been the case in the past, and this retractable arrangement is therefore a notable revolution in soaring.

The Carden-Baynes "Auxiliary" is a high-wing cantilever monoplane, with the wings in two sections, tapered from root to tip. Each half of the wing is quickly detachable at the root joint without disturbing the controls.

SPECIFICATIONS OF SAILPLANE

Wing span	45′ 6″
Wing area	120 sq. ft.
Aspect-ratio	16-to-1
Length	20′ 0″
Weight, empty	330 lbs.
Weight, loaded	520 lbs.
Normal speed, engine ret.	40 m.p.h.
Normal speed, engine out	50 m.p.h.
Sinking speed	2.2 f.p.s.
Glide angle, engine retr.	1-in-24
Glide angle, engine out	1-in-14

The fuselage is of oval section with a neck for the wing connection and engine unit. The structure is of spruce covered with plywood. No external bracing is used. The tail unit is in two parts, cantilevered halfway up, each unit being complete with elevator. This group can easily be detached without disturbing the elevator controls.

This is the germ of a new idea for our lightplane builders who have trouble in getting an adequate power plant for the heavier lightplanes. It is a possibility in a combined lightplane and glider club for it can be entered under both heads. And then, what about the D of C?

Here is the Carden-Baynes sailplane with the power-plant full retracted and out of the air-stream ready for soaring.

The Ashmusen Engine

MANY years ago, one of the pioneers in aviation, C. M. Ashmusen, presented an important improvement in aviation engines. This engine has many unique features, the most outstanding improvement being the auxiliary cooling system applied to the ribs of the air-cooled cylinders.

This improved cooling system, patented, consists of a series of tubes disposed around the cylinders through which air is drawn by the suction of the engine. The benefits derived are two-fold in their nature: (1) The rapidly flowing air cools the cylinders, and (2) The air is warmed for further use in the carbureter where it assists the evaporation of the gasoline. It proved very successful and passed grueling tests, but was never marketed because of the death of the inventor.

This is a positive cooling system, self-contained so that it is not necessary to project the cylinders into the air-stream as with other air-cooled engines. Further, no radiators, blowers or fans are necessary. All this conserves power so that the net horsepower is higher than would be the case in other engines where a considerable percentage of the power is employed for cooling the cylinders.

A 75 h.p. engine, weighing about 200 pounds, is now on the block where its efficiency can be tested. This weight can be reduced by the use of modern metals and by certain refinements in the design. The eight-cylinder engine has had about 500 hours of running and has proved both efficient and reliable.

This engine is built in the horizontal opposed type with the cylinder banks on opposite sides of the crankshaft because this type gives the maximum air displacement for cooling and, at the same time, has excellent balance qualities. The engine has no "left-handed" nor "right-handed" parts, hence all parts are interchangeable. It can be made to run right or left handed by changing camshafts.

Mrs. C. M. Ashmusen, widow of the inventor, has all of the drawings, patterns and tools for building the engine and is thoroughly conversant with its construction and manufacture. She wishes to dispose of the patents on a cash or royalty basis and can demonstrate the engine, which has so long been delayed.

Follow the Man From Cook's

AIR travelers in the New York metropolitan area have long felt the need of a consolidated air time table to make the choice of one's air transportation easier and to add convenience to the use of the air.

Now, Thomas Cook & Son-Wagon-Lits, Inc., issues such a table, which is a compilation of the schedules of all the transport lines serving New York at the Newark airport. It brings together for the first time in a single cover this information. New issues of the time table will be printed as changes in schedule occur.

Air-Sleepers On American Line

by MAX KARANT
Aviation Editor, Evanston News-Index

American Airlines reveals the details of the new DST Douglas Sleeper transports to be used on its airways. These new luxury liners are the last word in transport plane design.

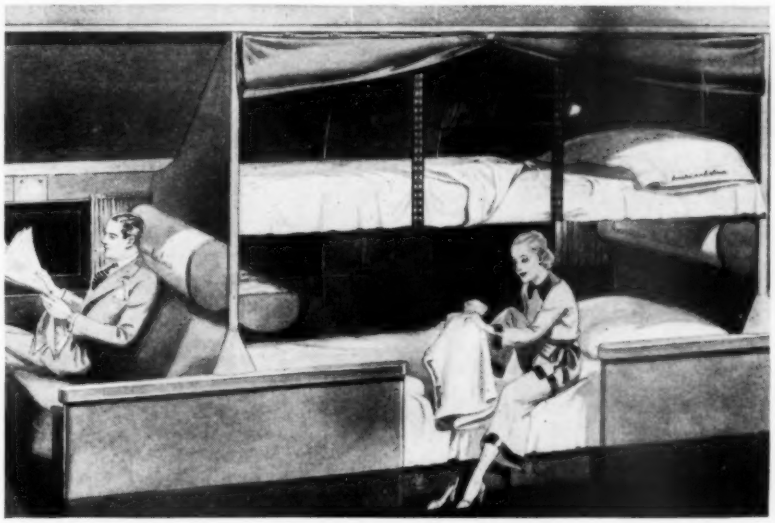
BEDS for the air traveler have long been the sparkling thought in the backs of the minds of air-transport companies, whether or not they admit it. Passengers never have enjoyed trying to sleep in cramped seats during a transcontinental journey. Today, however, things are looking up.

Years ago, the first established airlines carried their passengers—those who were hardy enough—in open nerve-wracking converted military ships. Observation and bombing planes chiefly went to make up America's fleet of "passenger" planes.

As the years passed, higher speeds and greater payloads were needed. Manufacturers (the few having enough vision) worked out the first true passenger planes. Crude, but with a hint of hitherto unknown comfort, the first transports sputtered, zoomed and glided their erratic way across the nation's roughly laid out airways.

More and more travelers took to the air and more and more travelers demanded to be more than just flown from one point to another in a chair. They wanted comfort, comfort and more comfort. One of the first real contributions to the air travelers' ease and facility was the fact that Henry Ford entered the airplane business. His engineering staff designed and built the first Ford airplane.

It was a single-engined ship and its performance showed hopes of altering the commercial aviation industry. But it wasn't quite enough. Then followed the now immortal trimotored Ford.



Interior view of the new Douglas DST plane used on American Airways. One of the sleeping berths is shown made up. Sleeping accommodations are provided for sixteen persons.

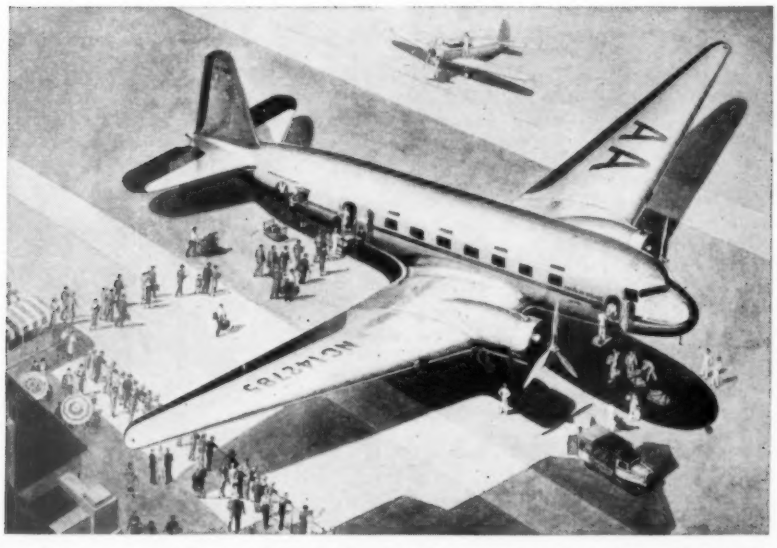
Here was an airplane designed for passengers with their comfort obviously predominant—at least for that period. Seats were inside a comparatively roomy cabin and they were comfortable—comparatively. Ten passengers could get together and take it more or less easy during their journey.

But those first Fords were noisy clattering contraptions. The air-traveler quit a Ford air liner temporarily deafened. The engineers' ideas on the modern airliner were undoubtedly far ahead of the time. They designed the Ford plane entirely of metal. Consequently, the tri-motored airliner was made up of steel tubing covered with sheets of duralumin that vibrated and rattled from the moment of take-off until landing.

Yet, the tri-motored Ford was the first honest-to-goodness air transport and was welcomed with open arms. Airlines of the day, not using at least some Ford equipment, were behind the times. Transcontinental flights and records first were made commonplace in Fords. As year after year went by, the Ford design was changed only slightly. Engines of greater horsepower were added and an attempt was made to quiet the cabin. More comfort was built into the passengers' quarters. But it was still a Ford.

From the Ford trimotor airliner to the modern Douglas is not so far and radical a leap as it would first seem. Fords still are piling up their phenomenal safety records throughout the civilized—and uncivilized—world. When United Airlines took delivery of their first Boeing monoplane transports, their time-worn Fords were retired. The old ships were sold in many corners of the world. So were American Airlines' Fords that had been replaced by Condors.

Ford suddenly quit the aviation industry. With the coming of the new era in luxurious high-speed airliners came thousands of new air travelers. Many of them, willing to sacrifice comfort for speed, left the luxury trains of the railroads for the smaller closer-quartered



Artist's conception of the new Douglas Type DST to be used on the American Airlines this spring. This is the largest plane built for passenger transport in the United States, with a gross weight of 12-tons and a top speed of 215 m.p.h. As a day plane it carries 24 passengers or 16 passengers when used as a sleeper.

XUM

airliner. People who flew were doing so because of the additional time saved.

But as the airliners' long range increased and the novelty of the new low-winged airliners (Douglas and Boeing) died out, there came the old bugaboo of air transportation back to haunt the airline operators—more comfort with their speed. But always more comfort.

Seats could now be tilted back and the passenger could snatch a few winks with some semblance of comfort. It was cramped and the space was rather limited but it was added comfort. One lone airline, however, took a surprisingly radical step.

American Airlines placed an order for the first "sleeper" planes known to commercial aviation. The ships were the comparatively slow Condors, the berths were small but they were better than trying to sleep in a cramped seat while flying from one coast to the other. At first, people were skeptical of undressing for bed 8,000 feet in the air. It was hard to believe that the flying American public was being given its first chance to curl up between cool sheets, poke a pillow snugly under their heads and go to sleep—at 145 miles an hour, a mile up in the night sky.

Even with the successful installation of the much-discussed Condor sleepers on certain American Airlines routes and schedules, that company's president, Cyrus R. Smith, wasn't satisfied. Temporarily, of course, they would do. People flew in them, slept in them and discussed them pro and con.

But Smith, being one of the most progressive far-sighted aviation men in the industry, watched the results obtained from the Condor sleepers closely. Would the American public take to the radical aeronautical departure? Would business men utilize the new feature? They would and did.

While the Condors were winging their way, night after night, carrying their sleeping burdens, American Airlines has acquired a fleet of the fast, quiet and roomy Douglas transports. Here Smith believed he had found more than just another air liner. Here was a design that had possibilities other than just being a fast 16-passenger day transport.

Here are the two dressing rooms, one for the men and one for the ladies. This is a decided innovation for aircraft.

Ladies' dressing room on the American Lines Douglas. Separate dressing rooms are provided for men and women at the rear of the cabin.

Could this Douglas design be used in developing Smith's almost fanatical hobby—the aerial sleeper? Could such an airplane take the airplane berth out of the small cramped (compared to Pullman berths) experimental class? These and many more questions Smith asked Douglas engineers. They answered him with blueprints.

While this was going quietly on, other airlines operated contentedly with the ships on hand. Passengers pulled on handles, tilted back their seats and tried to catch naps on the long cross-country flights. Stewardesses tucked blankets in around seat edges and there passengers slept. Smith has traveled in this manner many times on his own airline as well as on others and he doesn't like it. But his Condor sleepers weren't much relief, for he's six feet tall.

So, one day, a rumored $1,200,000 order was confirmed. The Douglas company had received the order from American Airlines and, most startling of all, was for a fleet of Douglas sleepers. Since that order was placed several months ago, Douglas' Santa Monica factory has been the scene of the birth of what can not help but be a new era in commercial aviation.

As this is read, the first of the fleet of these phenomenal airplanes nears completion. Not only are the berths in the new DST (Douglas Sleeper Transport) large and luxurious, but there are sixteen of them, each longer and wider. than a railroad Pullman berth.

Imagine sixteen berths measuring six-feet five-inches long and 35-inches wide each, in a spacious airliner having a cruising speed of 190 miles an hour at 12,000 feet and at only 70 percent. available power! Imagine that airplane with

(*Concluded on page 72*)

Grandpa is an Army Stunter

AGE doesn't make any difference in the ability of a stunt flyer, as was proved at the Cleveland Air Races by Capt. Claire Chennault, who led the "Three Men on the Flying Trapeze."

Capt. Chennault is the father of seven children and is a grandfather besides. Then, there is that old time Marine Corps pilot who is the father of five children and the oldest in point of service. So flying is a young man's game, eh?

Well—Well—Well

SOUTH DAKOTA and Vermont have no federally lighted airways within their respective borders. Chicago, St. Louis, Indianapolis, Cleveland, Pittsburgh, Atlanta and Newark have five lighted airway routes.

From a plane, Salt Lake City is a wonderful sight after sunset. The city itself is lighted up like a Christmas tree, while in five directions from the city, southwest, west, northwest, north and northeast, the flashing beacons are like a chain of fiery beads, visible for miles and miles in the clear air.

Autogiros for the Army

AFTER many delays, quibbles and side-stepping, the government has just purchased a new wingless autogiro for the U. S. Army Air Corps which is now being subjected to exhaustive tests.

This closeup view shows clearly the pylon arrangement of the new 'giro, and the characteristic engine mounting used on the ship. Note the clearance left behind the engine and the form of the nose, an arrangement entirely different than employed with the airplane.

This picture was taken at the 17th annual meeting of the Army Ordnance Association, Aberdeen, Md., proving grounds. Assistant Secretary of War, Harry M. Woodring, is shown in the cockpit.

Harry M. Woodring in army 'giro.

Pat Phrases Used in Aviation

by J. H. MEYER

PART II

During the past 35 years of aviation, the pilots, mechanics and builders have developed a language all their own. To the outsider, this may sound like slang, but really, these expressions are becoming idiomatic and a fixed legitimate part of our language.

BRASS NUT. An airport manager.

(C)

CHEW-UP. To cut destructively as to score a bearing or cylinder.

CHINESE ACE. An awkward pilot or flyer, particularly taken from flying "One Wing Low" or "Wun Wing Lo."

CHINESE LANDING. A rough landing with the wing tip scraping the ground.

CHISEL-RIDERS. Those who beg for a free ride.

CHIVY. To taxi slowly and cautiously.

CHOCKS. Blocks placed under the landing-wheels of an airplane to prevent it from running forward when the engine is idling or when the engine is being tested.

CHROME-MOLY. Abbreviation for Chrome-Molybdenum steel.

CLACKS. Engine valves.

CLEARANCE. (1) The space between a bearing and the shaft or the amount of space by which two parts are separated. (2) The space remaining between the piston and cylinder heads with the piston at the head end of the stroke. (3) The papers from the dispatcher or airport manager permitting a ship to leave port.

CLIMB. To ascend. (2) The rate of ascension measured above sea-level or the number of feet of ascent in a given time.

CLIMBING FOOL. A ship with a very high rate of climb.

CLINOMETER. An instrument for indicating the climbing or gliding angle of a plane's path with the horizon.

CLINKERS. Carbon deposits in cylinders.

CLIPPER. A long-range over-water flying boat.

CLOCK. To time a plane or determine its speed.

CLOUD-HOP. To remain in sustained flight by the force of upward air currents under cloud patches. To soar from cloud to cloud.

CO. Symbol (abbreviation) for carbon-monoxide gas emitted from the exhaust of the engine.

COCKPIT. The space or compartment occupied by the pilot or passenger in an open type plane.

COCKPIT TROUBLE. Trouble due to the incompetence of the pilot and not to the mechanical equipment. Trouble caused by lack of flying knowledge.

COCKEYED. Not in line or improperly adjusted.

COLD-LANDING. A landing made with a dead engine. Sometimes known as a "dead-stick landing."

COLD-NOSE. An engine that warms up slowly.

CONE (WIND). A conical bag of fabric suspended from the top of a mast to indicate the direction of the wind.

CONK-OUT. The engine stops accidentally by accident or by a defect.

CON-ROD. Abbreviation for connecting rod.

CO_2. Symbol (abbreviation) for carbon-dioxide gas emitted from the exhaust of the engine.

CONVERSION. An automobile or motorcycle engine that has been altered or converted to act as an aviation engine.

COOLING-TUNNEL. A passage within the engine compartment for conducting and distributing the cool air for an air-cooled engine.

COOTIE. A very small airplane or a lightplane.

CO-PILOT. An assistant pilot.

CORD (RIP). (1) A cord, which when pulled, allows the parachute to leave the pack and open. (2) A cord in the seam of a balloon envelope that, when pulled, rips the envelope wide open so that the gas will escape quickly when making a landing.

A case of cockpit trouble.

CORE. The heat radiating part of a radiator.

COUPE. A two-seated cabin type plane.

COUPLE. A pair of forces tending to cause the rotation of a body.

COVERING. Fabric, thin plywood, or sheet metal used for surfacing or as an outer skin for an airplane structure.

COW-PASTURE. A rough or poorly equipped airport.

COW-PASTURE POOL. Attempting to make a landing on a rough airport.

COW-PILOT. The stewardess or other feminine member of the crew.

C. P. Abbreviation for the center of pressure.

CRAB. (1) To point the ship between the desired direction and a cross-wind in order to reach the desired point when making a landing. (2) The side-wise or crablike motion of a plane when acted upon by a side-wind or cross-wind.

CRACKED GAS. Gasoline made from low-grade oils by subjecting them to high temperature and pressure.

CRACKING. To produce carbon deposits in the engine cylinders by the decomposition of low grade lubricating oils.

CRACK-OPEN. To very slightly open a valve, such as the throttle.

CRACK-UP. Damaging a ship in an accident.

CRACK-UPS. Damaged airplanes.

Take a guess at this one yourself.

CRASH. To demolish a plane in an accident.

CRASH-RIDER. A stunt pilot who intentionally crashes or breaks up a ship in exhibition work.

CRASH-HELMET. A heavy protective hat or helmet for protecting the pilot in an accident.

CRATE. A derisive name for an old obsolete or erratic airplane.

CRAZY. Generally applied to unmaneuverable planes.

CROSS-COUNTRY. A long flight outside of the home airport, taken between two definite points.

CROSS-WIND. A wind blowing at approximately right angles to the line along which the airplane is travelling.

CROW-FEET. Small patches cemented to a balloon envelope for making connections to cords and shroud-lines.

CROW'S-NEST. A small observation cabin placed on top of an airship or dirigible.

C. R. S. Abbreviation for "cold-rolled steel."

CRUISE. To fly at the most efficient speed of an airplane at which the fuel consumption is at a minimum.

CRUISING SPEED. The most efficient speed of an airplane or airship.

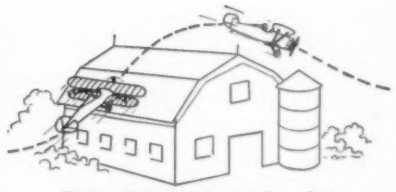
CUT-OFF. A device for the control of fuel injection in a Diesel engine, that limits the injection to an early part of the stroke.

CUT-OUT. To turn off a valve or to close throttle.

C. W. A radio term meaning "continuous wave."

(D)

DAG. A very fine graphite for mixing with lubricating oil.



Just a Barnstormer on the wing.

D. C. (1) Direct connected. (2) Direct electric current, flowing constantly in one direction. (3) Dead-center.

DEAD. (1) Stopped. (2) Exactly, or only.

DEAD-RECKONING. Navigation by calculation of speed and time.

DEAD-STICK. Propeller and engine "dead" or stopped. Not running.

DEAD-STICK LANDING. Landing an airplane with the engine stopped.

DEMOISELLE. A type of early lightplane, developed by Santos Dumont, that has much the appearance of a modern power-glider.

DEP CONTROLS. A wheel type control system employed on some large planes, named after its inventor, Deperdussin.

DEW-POINT. The temperature at which the air becomes saturated with water vapor and begins dropping the moisture in the form of fine mist or water particles.

DOCK. A hangar or shed for storing airships or dirigibles.

DODO. A flying cadet in the air corps. The training period is his "dodo days."

DOG-FIGHT. A general combat between planes without formation. Fighting, catch-as-catch-can.

DOG. A sharp pointed stick on the landing gear which, when forced into the earth, will prevent the plane from rolling. Also known as a "sprag."

DOG-HOUSE. An exposed cabin projecting from the main line of the plane.

DOILY. A derisive name for a piece of dirty oily waste.

DOPE. A form of cellulose varnish used for impregnating, shrinking and waterproofing the fabric coverings of an airplane.

DOT-DASH. A radio transmission by code instead of voice.

DOWN-GEAR. An order for letting down the retractable landing gear when making a landing.

DOWN-WIND. In the direction of the wind.

DOWN-WIND LANDING. A landing made in the direction of the wind, objectionable because of the increased landing-speed due to the wind velocity.

DRACHEN. A kite balloon or captive balloon of the cylindrical sausage type.

DRAG. (1) The resistance caused by the wings of an airplane. (2) To fly low over the ground in search of a landing place.

DRIP-BAND. A skirt around the lower portion of a balloon or airship envelope that prevents moisture on the bag from dripping down into the car.

'DROME. Abbreviation for airdrome or airport.

DUAL-CONTROLS. A plane provided with two separate sets of flying controls that can be operated independently by two persons, generally the instructor and his student.

DUAL TIME. The number of hours flown by a student with his instructor accompanying him.

DURAL. A very light metal used in airplane construction.

DUST-BIN. A projecting cabin or turret on a military plane provided for the protection of the gunner.

D. X. A radio term for "long distance."

(E)

EAGLE-EYE. The observer in a military plane.

EASY STICKING. A plane that flies easy with little need of control.

ECHELON. (1) Tandem seat arrangement. (2) A military flight formation.

EGG. A bomb.

EGG-CRATE. A bomber.

F°. Fahrenheit temperature degree.
F. A. I. Abbreviation for "Federation Aeronautique Internationale," the international authority for the recognition of flight records.
FADING. The loss of volume or signal strength in radio reception due to atmospheric variations.
FAG. The gradual loss of power in an engine due to continuous service and changing adjustments.
FAIRING. Falsework over the main structure for maintaining the shape of the covered outer surfaces.
FAIRNESS. The degree of streamlining possessed by a plane or other object moving through the air. The "fairness ratio" is the ratio of the length, taken along the direction of the air stream, to the width.
FAMOUS LAST WORDS. "The parachute didn't open."
FAN. To race the engine in intermittent bursts of speed.
FIGHT. To struggle with.
FIGHTING CONTROLS. (1) Unnecessary use of the controls or over-controlling an airplane in flight. (2) Continuous and difficult handling of the controls in rough weather.
FIN. (1) A fixed control surface. (2) A five-cylinder radial engine.
FIRE-WATER. Gasoline.
FISH-TAIL. A maneuver for losing altitude without gaining forward speed, used when landing in restricted fields. The tail is wagged back and forth rapidly, thus introducing forward resistance.
FLABBY. Not completely filled. A flabby balloon is one not completely filled with gas under pressure.
FLAG. The tail-group.
FLAP. Any small hinged control surface.
FLAPPING-WING TYPE. A type of aircraft employing flapping or beating wings similar to the wings of a bird.
FLARES. Torches for momentarily lighting landing fields.
FLAT-SPIN. A spinning diving descent, due to incorrect design of the plane, in which the plane is more nearly horizontal and descends more slowly than in the usual spin. This always causes a crack-up although it is usually safer than the steep nose-spin.
FLIGHT. A formation consisting of a number of planes. The organization varies in the military services of the various countries.
FLIPPERS. The horizontal control surfaces in the tail-group, commonly known as the "elevators." In normal flight, they control the ascent and descent of the plane, but when banked up to or over 45 degrees, the flippers act like a rudder.
FLIPPER-TURN. A right or left-hand turn with the plane banked up over 45 degrees, the flippers or elevators acting as a rudder.
FLIVVER. A small airplane.
FLOATER. An airplane or model, very lightly loaded per square foot, that is sustained in flight at very low speeds.
FLOOR. The lowest point accessible to a plane. Sometimes, the floor is taken as being sea-level.
FLUNKY. One who works for nothing in order to get in some flying time.
FLUTTER. Vibration of a plane or parts of a plane in flight.
FLYING THE BEAM. A plane flying along the path of a radio beacon, the path consisting of a narrow lane of radio waves by which the pilot can determine his direction.
FLYING BLIND. Flying without seeing the ground or being guided by other visible landmarks. Flying is conducted by means of the navigating instruments only when the ground is obscured by clouds or fog.
FLYING CAMERA. An observation plane.
FLYING BY HIS PANTS. A pilot that flies by the distribution and feeling of his weight on his seat, or by the feeling of balance. He sits more heavily on the right side when the right wing-tip is high.
FLYING WING. An airplane with all of the surfaces, lifting and control, incorporated into one large surface, much like the wings of a bat.
FOAM CANS. Foam type fire-extinguishers.
FOG-STABBERS. Aerial cameras employing infra-red filters and plates for piercing the fog or clouds.
FOLD UP. To quit or fail in business.
FORMATION. A military flight of several planes arranged in a regular pattern or in geometrical order.
FREEZE. To clutch quickly or to hold persistently to an object.
FREEZING BEARINGS. Overheated bearings that seize the shaft.
FREEZING THE CONTROLS. A person, generally frightened, seizes the controls and takes them away from the pilot. A frightened student will frequently hold the controls with a death grip, making it impossible for the instructor to handle the ship. A crash is inevitable.
FUMIDOR. A plane having leaky exhaust manifolds or leaky gas lines that fill the cabin or cockpit with vapor or fumes.

(*Concluded on page* 66)

The New Stinson Reliant Type SR6-A Appears

(See Front Cover)

The new Stinson Reliant which is creating a sensation among sport-type cabin planes this season.

ONE of the most completely appointed planes in the medium price field, is the new 4-seat Stinson Reliant Type SR6-A in which all of the smaller details and refinements have been given the utmost attention. Unlike planes of the past, much attention is now being given to beautifying the interior arrangements and to the comfort of the passengers. And this modern idea predominates in the Reliant.

One of the most interesting of the mechanical features is the vacuum type flap system which enables very slow landings to be made in fields of restricted area. These flaps are very simply controlled by pressing a push-button, doing away with much of the inconvenience hitherto experienced in the operation of trailing wing flaps. With flaps, the landing roll is cut to 200 feet, and the addition of effective brakes adds to the safety factor in landing.

The standard Reliant, Model SR6-A,

(*Concluded on page* 68)

Here we have "Andy" of the famous "Amos and Andy" radio team, in private life known as Mr. C. J. Correll, who is an enthusiastic owner of a Stinson Reliant. Mr. Correll's ship is shown on the front cover and has the same color scheme as that shown by the drawing.

A view of the interior of the Stinson Reliant cabin.

The World's Planes and Builders

In this second tabulation, continued from the November issue of POPULAR AVIATION, will be found the principal airplane builders of most of the remaining countries. We wish to acknowledge assistance from Jane's *All the World's Aircraft* in making this compilation. In this issue, we list such great productive countries as France, Germany, Italy and Holland.

FRANCE (Continued)

P. Levasseur, 17/21, Place Felix-Faure, Paris.	Lavasseur P.L.9.	2-seat biplane for deck-landing training.
	Lavasseur P.L. 101.	3-seat deck-landing biplane.
	Lavasseur P.L. 15.	3-seat torpedo-carrying seaplane.
Establissements Lioré-Et-Olivier, 66, Rue Boissiere, Paris.	Lioré-Et-Olivier LeO-20.	Twin-engine military bombardment biplane.
	Lioré-Et-Olivier LeO-206.	Similar to type 20.
	Lioré-Et-Olivier LeO-256 and 257.	Twin-float torpedo-bomber seaplanes.
	Lioré-Et-Olivier LeO-30-0.	4-engine night-bomber.
	Lioré-Et-Olivier LeO-30-1.	4-engine night-bomber.
	Lioré-Et-Olivier H-23-2.	1-engine observation amphibian.
	Lioré-Et-Olivier H-24-2.	4-engine long-range commercial flying-boat.
	Lioré-Et-Olivier H-27.	4-engine, long-range postal flying-boat.
	Lioré-Et-Olivier H-199.	Twin-engine commercial flying-boat.
Les Ateliers Et Chantiers de La Loire, 4, Rue de Teheran, Paris.	Loire 43.C1.	Single-seat fighter.
	Loire 45.C1.	Identical to the 43.C1 except fitted with different type engine.
	Loire 46.C1.	Variant of the 45.C1.
	Loire 70.	3-engine flying-boat.
Avions Mauboussin, 1, Rue Choiseul, Paris.	Mauboussin "Corsaire".	2-seat light monoplane.
Aeroplanes Morane-Saulnier, 3, Rue Volta, Puteaux (Seine).	Morane-Saulnier 225.C1.	1-seat fighter monoplane.
	Morane-Saulnier 227.C1.	This is the 225 equipped with a different engine.
	Morane-Saulnier 275.C1.	Development of the 225.C1.
	Morane-Saulnier 325.C1.	Low-wing braced monoplane.
	Morane-Saulnier 230.	2-seat advanced training monoplane.
	Morane-Saulnier 330.	2-seat training monoplane.
Les Ateliers De Constructions Du Nord De La France, 54, Avenue Marceau, Paris.	Mureaux 113.R2.	2-seat observation monoplane.
	Mureaux 170.C1.	1-seat fighter monoplane.
Societe Anonyme Nieuport-Astra, 4, Rue De Teheran, Paris (8e).	Nieuport 121.C1.	1-seat high-altitude fighter monoplane.
	Nieuport 122.C1.	1-seat high-altitude fighter monoplane.
	Nieuport 125.C1.	Similar to the 122.C1 with a slight modification of the engine mounting.
	Nieuport 580-R2.	2-seat long-distance reconnaissance monoplane.
	Nieuport 590.COL.3.	3-engine general-purpose colonial monoplane.

(*See next page*)

The Breguet-Wibault 670, a French transport inspired by the Douglas DC.2. This is an all-metal plane powered by two Gnome-Rhone engines of 810 h.p. each. It has a cruising speed of 205-210 m.p.h., carrying 19 passengers and has a cruising range of 800 miles.

Constructions de Planeurs à Moteur Auxiliaire, 26, Rue de Bassano, Paris (XVIe).	P.A.M.A.	1-seat light cabin monoplane.
Aeroplanes Henry Potez, 75, Avenue Des Champs Elysees, Paris (8e).	Potez 25.	2-seat observation, long-distance light bombing or fighting biplane.
	Potez 39.A2.	2-seat observation monoplane.
	Potez 41.	4-engine bomber with retractable undercarriage.
	Potez 50.A2.	Development of the type 25.A2.
	Potez 54.	2-engine multi-seat fighter.
	Potez 56.	6-passenger commercial monoplane.
	Potez 58.	3-seat light cabin monoplane.
Chantiers Aeronavals E. Romano, 3, Square Merimee, Cannes (A.M.).	Romano R-5.	1-engine observation flying-boat.
Société Provencale de Constructions Aéronautiques, 3, Rue de la Baume, Paris.	S.P.C.A. 81.COL.2.	1-engine colonial monoplane.
	S.P.C.A. 90.COL.3.	3-engine colonial monoplane.
	S.P.C.A. 91.T.	Commercial plane for eight passengers and crew of two.
Societe Des Moteurs Salmson, 102, Rue De Point-Du-Jour, Billancourt (Seine).	Salmson "Phrygane".	3-seat light cabin monoplane.
Chantiers Aéronautiques Wibault-Penhoet, Courbevoie and Saint-Nazaire.	Wibault-Penhoët 28.T.	3-engine ten-passenger monoplane.

GERMANY

Adlerwerke G.m.b.H., Frankfurt Am Main.	Adler G.11.Rc.	2-seat light monoplane.
Arado Flugzeugwerke G.m.b.H., Wanemunde, Schliessfach 28.	Arado Ar. 66.	2-seat biplane for training.
	Arado Ar. 69a and 69b.	2-seat light training or sport biplane.
Bayerische Flugzeugwerke A.G., Augsberg.	B.F.W. M-35.	2-seat light monoplane for instruction or sport.
	B.F.W. M-108.	4-seat cabin low-wing monoplane.
Bücker Flugzeugbau G.m.b.H., Gross Berliner Damm, Berlin-Johannistahl.	Bücker "Jungmann".	2-seat training plane.
The Darmstadt University Aviation Society (Academische Fliegergrupxe), Technische Hochschule, Darmstadt.	Darmstadt D.22.	2-seat lightplane.
Dornier Metallbauten G.m.b.H., Friedrichshafen A.B.	Dornier "Wal".	For passengers, mail or freight.
	Dornier "Wal 1933-34".	Long-range flying-boat.
	Dornier Do.C2.	Mail-carrying float-seaplane.
	Dornier Do.F.	Twin-engine mail carrying landplane.
	Dornier Do.K.	10-passenger monoplane.
	Dornier Do.12 "Libelle".	2 or 3-seat amphibian.
Erla-Maschinenwerk G.m.b.H., Heiterblick 17d, Sommerfelder weg Leipzig, N.24.	Erla 5.	1-seat lightplane.
Espenlaub-Flugzeugbau, Dusseldorf-Flughafen.	Espenlaub E.14.	2-seat light monoplane.
Fieseler-Flugzeugbau, Kassel-Bettenhausen,	Fieseler F.5.	2-seat lightplane.
	Fieseler F.97.	Low-wing cantilever cabin monoplane seating four.
Focke-Wulf Flugzeugbau A.G., Flughafen, Bremen.	Focke-Wulf FW-44B "Stieglitz".	2-seat machine for training.
Ernst Heinkel Flugzeugwerke G.m.b.H., Warnemunde.	Heinkel H.D.42.	2-seat seaplane for school or sport use.
	Heinkel H.E.64C.	2-seat sport plane.
	Heinkel H.E.64D.	The H.E.64 fitted with a "Gipsy III" engine.
	Heinkel H.E.70A.	7-seat commercial monoplane.
	Heinkel H.D.72 "Kadett".	2-seat open-cockpit trainer biplane.
Junkers-Flugzeugwerk A-G., Dessau.	Junkers W.34.	Cabin monoplane for freight or passengers.
	Junkers G-38.	4-engine commercial monoplane.
	Junkers Ju.46.	The W.34 seaplane developed for catapult launching.
	Junkers Ju.52.	Commercial cabin monoplane.
	Junkers Ju.52/3m.	3-engine version of the Ju.52.
	Junkers Ju.160.	6-passenger cabin monoplane.
Leichtflugzeugbau Klemm G.m.b.H., Boblingen (Wuertemberg).	Klemm KL.25 and KL.26.	2-seat lightplane.
	Klemm KL.31.	4-seat lightplane.
	Klemm KL.32.	3-seat light cabin plane.
	Klemm KL.36.	4-seat cabin monoplane.
Flugzeugbau Bernhard Scheller, Vorwerksgasse 9, Celle.	Scheller S.IV.32b.	2-seat light monoplane.
Flugzeugbau Wagener, Halle 8, Hamburg Flughafen.	Wagener H.W.4A.	1-seat lightplane.

GREECE

The Greek National Aircraft Factory, Old Phaleron, Athens.	Have constructed a number of Blackburn "Velos" 2-seat torpedo planes, a series of "Atlas" 2-seat fighters, and a number of Avro training planes, types 504-O and 594-N.

GUATEMALA (None)

(*Continued on page 60*)

The First Atlantic Crossings

by ALBERT W. JUDSON

An article in which credit is given to the earliest transatlantic flyers, thus settling a much disputed point among newcomers in aviation. Instead of being first, Lindbergh was the tenth man to cross the Atlantic Ocean.

ASK any group of men in the street the question, "Who made the first transatlantic flight?" and it is probable that all ten, or at least nine men out of the ten, will answer, "Lindbergh."

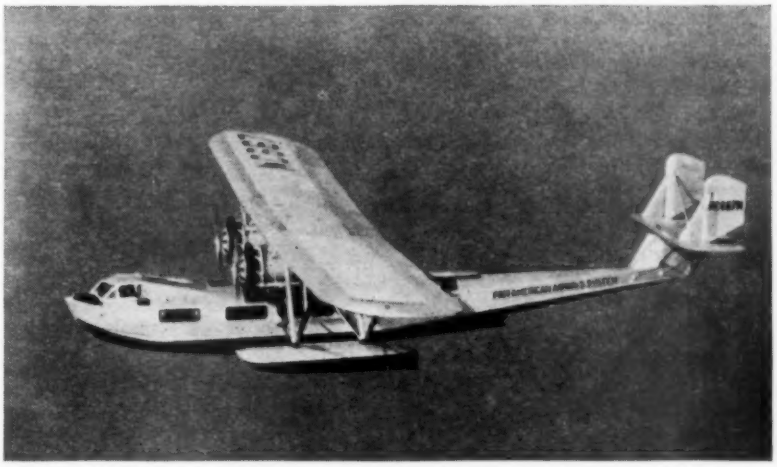
Ask a similar group why Commander Read is entitled to fame and you will only draw a wondering glance and a curt "I don't know." And yet, history shows that Commander Read flew across the Atlantic a good eight years before Lindbergh took off for Paris.

Because of the consistent and long continued front-page publicity and headlining in the daily papers, the average citizen has been educated to the idea that Lindbergh is the genesis of aviation and the first to soar across the Atlantic. We have even received letters in our offices asking us the date on which Lindbergh invented the airplane and if he had exclusive patents on it! To the man in the street, all that has taken place in aviation before 1927 is forgotten or ignored.

Now, it is not our purpose for one moment, to demean or belittle the Lone Eagle's wonderful accomplishment in the slightest degree but we do wish, out of a feeling of justice for the men who made the crossing earlier than the Colonel, to give these men credit for a still more remarkable success and achievement. The history of these earlier transatlantic flights has so long been submerged under the worshipful adulation for Lindbergh that we believe that it is only fair and fitting that the names of Read, Brown, Alcock and others be candidates for equal public esteem.

Commander Read and his valiant crew have never received the acclaim that is properly theirs for the first transatlantic flight, possibly for the reason that they were then in the service of the navy and therefore were expected to perform heroic acts without much applause. Again, Brown and Alcock, who followed Read by a scant month (and eight years before Lindbergh) are hardly remembered by the average newspaper reader. As a matter of fact, the Alcock-Brown achievement received comparatively little attention in the aviation magazines.

And, while these very early crossings were being made in the North Atlantic, still more frequent flights were being made across the South Atlantic from Europe to South America. Of these, the public has seldom heard or else quickly put out of mind. Nothing interested the public in transatlantic flight, nor nothing mattered, until the magic of Lindbergh was called to the attention of the citizen by intensive display-head broadcasts.



A Clipper Ship of the Pan American Airways on a scheduled run. This is the direct outcome of the historic transatlantic flights listed here.

Among the early pioneers in the South Atlantic, and those preceding Lindbergh, were Cabral, Franco, de Alda, de Barres, de Pinedo, del Prete and de Beires, most of whom received but short notice and little attention in the newspapers. Air traffic across the South Atlantic then, just as it is today, was far more frequent and more consistently successful than in the North Atlantic. Scheduled transoceanic flights are now a present actuality in the south but not in the North Atlantic.

A careful examination of the accompanying tabulated data will present many interesting facts to newcomers in aviation. It will show the status of transatlantic flying before the Lindbergh era and for three years after this episode. It will show the preponderance of South Atlantic crossings over those in the North Atlantic.

First. The North Atlantic had been crossed exactly nine times before the Lindbergh flight, many times with antiquated wartime equipment.

Second. Of the nine prior flights, five were made in the South Atlantic and one crossing was with a dirigible.

Third. That eight full years had elapsed between the first crossing and the Lindbergh flight.

Fourth. That seven other flights were made in the same year (1927) that Lindbergh made his flight.

Commander Read and his crew, in the NC-4 flying-boat, marked an epoch in aviation. It was a little trip into the

(*Concluded on page 70*)

A Schedule of the Early Transatlantic Flights

ORDER	Commanding Pilots	North or South	Date	Name of Plane	Dist. in Miles	Elapsed Time
1	Commander Read, Crew	NA	May 16, 1919	NC-4	4,791	53:58:00
2	Brown (Eng.), Alcock (USA)	NA	June 14, 1919	Vimy-Vickers	1,890	16:12:00
3	Major Scott	NA	July 2, 19	R-34 (Dirigible)	3,270	108:12:00
4	Cabral-Coutinho	SA	Mar. 30, 1922		3,750	
5	Around the World Flyers	NA	July 17, 1924	Chicago-New Orl.	2,850	39:23:00
6	Franco & DeAlda	SA	Jan. 22, 1926	Ne Plus Ultra	3,879	37:25:00
7	de Barres & Cunha	SA	Apr. , 1927	Jahu	3,519	
8	de Pinedo & del Prete	SA	Feb. 19, 1927	Santa Maria	2,290	
9	de Beires	SA	Mar. 16, 1927	Argos	1,560	17:30:00
10	Chas. Lindbergh	NA	May 20, 1927	Spirit of St. Louis	3,620	33:29:00
11	Chamberlain & Levine	NA	June 4, 1927	Columbia	3,930	42:00:00
12	Commander Byrd	NA	June 29, 1927	America	3,490	40:00:00
13	Brock & Schlee	NA	Aug. 27, 1927	Pride of Detroit	2,350	23:21:00
14	Costes & LeBrix	SA	Oct. 14, 1927	Nungesser-Coli	1,980	18:05:00
15	Huenfeldt & Koehl	NA	Apr. 12, 1928	Bremen	2,070	37:00:00
16	Stultz & Earhart	NA	June 17, 1928	Friendship	4,449	20:40:00
17	del Prete	SA	July 3, 1928		4,450	51:59:00
18	Jiminez	SA	Mar. 2, 1929	Jesu del-Poder	4,067	44:00:00
19	Assolant & Lefevre	NA	June 13, 1929	Yellow Bird		29:52:00
20	Williams & Yancy	NA	July 8, 1929	Pathfinder		

How They Build Planes in Japan

Three interesting photographs of Japanese military planes have been contributed to this column by one of our Japanese readers. These are "shots" that are not often seen.

WE ARE indebted to Mr. N. Natsumura, 1687 Hama, Isogo-Ku, Yokohama, Japan, for these excellent and interesting photographs of Japanese military and naval planes. They are illustrative of the most recent developments of Japanese aviation which, as the photos show, has been quite remarkable.

One of the most interesting of the Japanese planes is the Nakajima Type "90" naval shipboard single-seat fighter, an all-metal framed fabric covered plane that is powered with a 450 h.p. Nakajima-Jupiter engine. The Townend ring, and the portion of the ship back as far as the cockpit, with the exception of the landing-gear, is somewhat Boeingesque, if we can be pardoned original terminology. The general specifications read:

TYPE "90" NAKAJIMA FIGHTER

Span	28′—8½″
Length	21′—7″
Height	10′—6″
Loaded weight	2,200 lbs.
Power-plant	450 h.p.
Max. speed	186 m.p.h.

Second, is the thoroughly modern Type "93" army bomber, an all-metal bimotored bomber with several novel features. It seats four and has a maximum speed of 150 m.p.h., climbing to 10,000 feet in ten minutes.

Like the Junkers, it is covered with corrugated dural both on the fuselage, wings and engine nacelles. The use of the twin fins and vertical rudders in the tail group is quite an interesting arrangement for this size of ship.

Its power-plant consists of two 9-cylinder 450 h.p. Jupiter engines mounted in quite sizeable nacelles on the leading edge of the wing. The nose cabin is quite cleverly arranged so that the visual range is at a maximum together with a minimum of head-resistance. The following specifications are of interest.

TYPE "93" ARMY BOMBER

Wing span	65′—7″
Wing area	565 sq. ft.
Height	13′—2″
Seats	4
Loaded weight	10,120 lbs.
Power-plant	900 h.p. total
Max. speed	150 m.p.h.
Climbing rate	1,000 f.p.m.

The wing, in which there is a quite noticeable dihedral, is of the cantilever type with a novel method of framing into the fuselage. While not stated, it is apparent that the landing gear is of the rigid order.

From the third picture it is quite obvious that the Japanese army devotes a great deal of time to formation flying. This fine flight picture shows a flight of Kawasaki two-seater reconnaisance—light bomber type, known as Type "88." These ships are equipped with 500 h.p. Kawaseki-B.M.W. engines. The performance figures are not given.

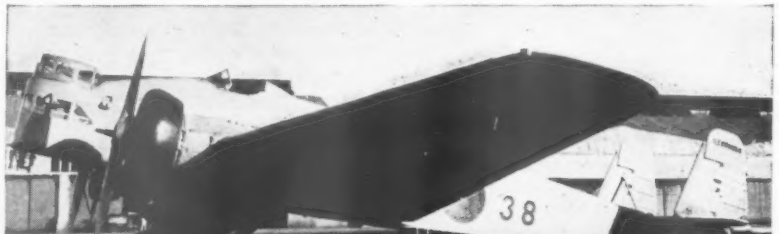
A close inspection of the "90" shipboard fighter, discloses the fact that our artist, Herman Bollin, has missed a fancy insignia. Just take a look at the tail group and the rear of the fuselage. But we'll give him credit for one thing, and that is, the solid red circle which he did show on a past issue.

Japan, we understand, is building planes and engines under license from several European countries, Junkers being one of these firms. But, despite this fact, the planes have a distinct individuality, or personality if you prefer, that marks them apart from those produced by the European licensees.

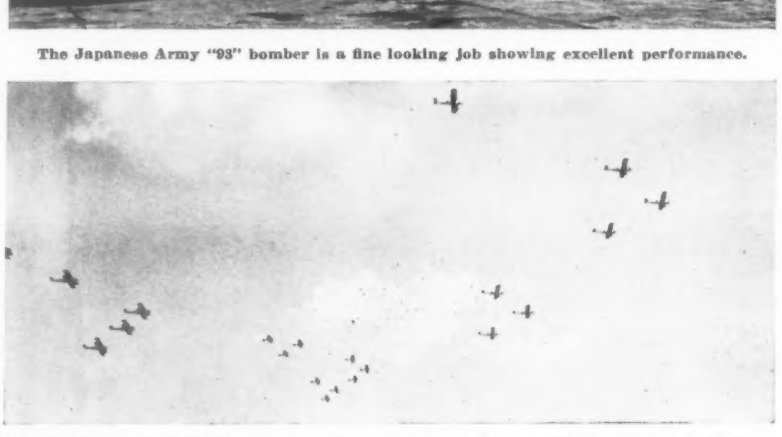
And so, we trust that Natsumara will favor us with some more of these photos and a good description of them.

These Japanese Warplanes Are Unique

The Nakajima "90" Naval type shipboard fighter, which, at the nose end, at least, recalls Boeing.



The Japanese Army "93" bomber is a fine looking job showing excellent performance.



A formation flight of the Japanese army Type "88" Kawasaki two-seat Reconnaisance bombers.

Hospitals on the Wing

by S. R. WINTERS

Surgeons have discovered a new use for the airplane which promises to revolutionize the technique of certain operations. It, in other words, eliminates the danger of bacterial infections.

INTRODUCING a new epoch in the history of aviation and surgery alike, aerial hospitals offer a remarkable but feasible actuality in the elimination of bacterial infection from future surgical operations.

Dating back to the third and fourth centuries, before the Christian era, an effective aseptic to prevent or arrest contamination of wounds, has remained a continuous quest of the human race, with only a partial degree of success. Ancient Assyrians are said to have employed honey for this purpose while the Greeks made use of pitch and other tarry substances in treatment of wounds.

Their crude practices were eventually superseded by discovery of antiseptic surgery many centuries later, through the experiments of Dr. Joseph Lister. Early in medical annals, the apparent harmful effect of air upon wounds was stressed and this famous surgeon of the 19th century conceived the theory of creating an antiseptic atmosphere surrounding the incision.

As a means to that end, he sprayed the patient and all those engaged in the operation with a fine mist of diluted carbolic acid solution, believing in this manner he could produce sterility of all surrounding atmosphere. Later he abandoned his system entirely, when ensuing developments proved the spray did not destroy all the bacteria present but merely assisted in maintaining purity of the surgeon's hands.

Since that time, the unequal struggle against infringement of various microorganisms has continued unabated, with infection constituting a major problem of surgery.

Now we hear the surprising announcement that Nature has surpassed the more or less ineffectual efforts of mankind by providing an infinite laboratory high above the earth, carefully sterilized to meet stringent demands of the most exacting physician.

At altitudes of 20,000 feet or more, the air is sterile and free from all the varied forms of organic life so often fatal to the patient seeking surgical relief. Henceforth, the modern surgeon may soar gently upward in his well-equipped plane to perform an abdominal operation, for instance, without possible complications of septicaemia or peritoneal infection.

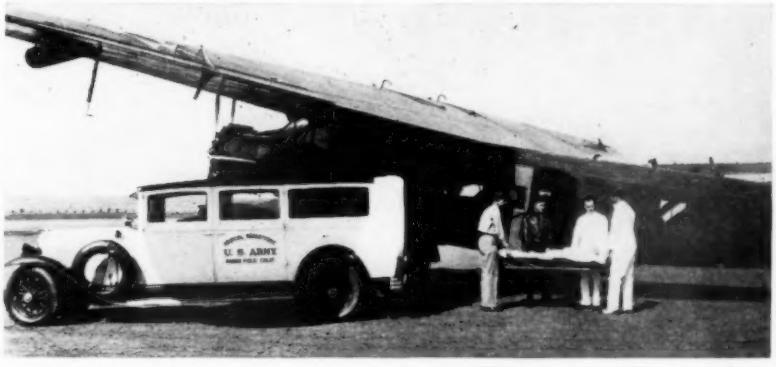


Photo by U. S. Army Air Corps.

A Fokker C-7A belonging to the U. S. Army Medical Department as an ambulance ship. In addition to the patient it also carries a flight surgeon and attendants.

Proposed aerial hospitals supplant or supplement the work of flying ambulances which have been used successfully to transport seriously ill or injured persons to base hospitals or for carrying necessary personnel and means of treatment to sick and wounded during public calamities such as floods, storms, earthquakes or fires.

In countries having a widely scattered population with inferior communications, and more especially in warm regions, the ambulance plane is an invaluable aid, since it accomplishes in a short period of flight a task that would require prolonged hours of transportation.

Perhaps the French are actual originators of aerial ambulance service for in 1910 a stretcher was placed on a French plane, being kept near the center of gravity of the machine. At the end of that same year, the Dutch general-surgeon McCay proposed use of airplanes for removing wounded soldiers from the battlefields. Thus we see that utilization of planes for preservation of health slightly antedates their use as war machines.

Realizing the great importance of flying ambulances, all nations have planned to construct or adapt planes which meet the medico-surgical exigencies. In England various types of real aerial ambulances were built, among them a plane carrying twelve passengers and a crew of two. Italy has devised a plane to accommodate nine wounded, a surgeon, nurse, two pilots and necessary surgical and pharmaceutical material. The Swiss Red Cross successfully adapted the Junkers F-13, a type which also met with approval in the French-Moroccan campaign.

Because of the peculiar conditions of her colonial empire, France has contributed much to the progress of plane-ambulance service and offers, therefore, varied and convincing statistics. In three years, approximately 2,800 sick and wounded French subjects, who could not have been transported by other means, were evacuated.

In the United States, three types of mercy ships have been designed, including a Fokker, Cox-Klemin, and Douglas planes. A later model Fokker is powered by a single Wright Cyclone motor with a top speed of 130 miles per hour and cruising range of 115-120 miles an hour. This mercy ship, white in color, carries three litters for patients and three seats for doctors or attendants; it is equipped with oxygen apparatus for altitude flying and for treatment.

Since the conversion of passenger to ambulance planes may be accomplished in a relatively short time without materially changing the structure, there is a growing tendency toward adaptation rather than especially designed mercy ships. In accordance with this policy, the United States Navy Department has abandoned the use of specified types and

The plane of the Mac Dougall Air Ambulance service, a commercial invalid transport system, ready to receive a patient from the auto ambulance. This company maintains a "bed-to-bed" service, employing the plane and an auto ambulance at both ends of the trip.

XUM

chosen ordinary utility planes for present ambulance needs.

Among the many requisites of an ambulance plane are easy riding, combined with abundant power and freedom from vibration. For certain kinds of work the plane should be capable of quick take-off and slow landing, despite rough ground; ability to alight upon and get away from small fields is also an important essential. Multi-motored planes that maintain flight with one or possibly two motors not functioning seem preferable; also a speed of not less than 100 miles per hour and fuel capacity of six hours or more are necessary details.

On account of the varied and unfavorable weather conditions likely to be encountered by the winged ambulance, it should be equipped with stabilizing apparatus, a heating system, ventilation method for the cabins, navigation instruments and requisites for blind flights and night flying. Ordinarily, cruising speed should be rather low to permit stability, comfort and increased load.

Present solution of the aerial ambulance problem has been suggested in the use of the autogiro since special qualities possessed by this machine render it particularly adaptable for humanitarian purposes.

Apart from the study of flying ambulances but continuing in the direction of life-saving, Army Air Corps technicians have recently developed a model for a parachute ambulance to lower injured or unconscious persons from a disabled airplane.

This device utilizes a standard 30-foot parachute and consists of a close-fitting cylindrical padded cage, tapered to a point at the bottom. Encircling the cage is a series of spring rods, similar to the ribs of an opened umbrella, which prevents the contrivance from striking the ground broadside and minimizes dragging. This parachute is equipped with a shock absorber and carries the conventional litter.

This is the basket type stretcher, light, strong and easy to handle. Note the form of the door.

A Special Bed For Dream-Ship Fans

Made to order for the dream-ship designer. Two hours in this affair would be productive of 15-motored planes with retractable wings.

AT a recent furniture show in Chicago, a bed was shown which should have the instant attention of our dream-ship designers. It is just what the doctor ordered for midnight flights of fancy.

Please observe the propeller on the dashboard (beg pardon—foot-board) and the radial cylinder arrangement at the head of the bed. Just how the young lady fits into the picture is difficult to say, at the present moment, for we have not as yet had any young lady contributors to this department. On second thought, however, perhaps she represents the streamlining feature. Who can tell? At any rate, it's a nice picture.

Landing Autogiros on Postoffice Roofs

THE recent landing of mail on the roof of the new Post Office in Philadelphia attracted attention to the utility of the autogiro in a field of aviation often considered but never before realized.

It has definitely proven the contention of 'giro enthusiasts that such accomplishments are not only possible but will in time be thoroughly practical. The dedication of this Post Office marks the inauguration of a new idea in transportation—the first landing space constructed for autogiros on the roof top of a large city.

The feasibility of the idea, now conclusively proven, should be kept in mind for the future planning of the city buildings. It serves as a practical solution to one of the outstanding problems of air travel in providing rapid and convenient transportation from airports to the center of cities.

Just as aviation was developed in its earlier stages through the necessity of a more rapid system of mail transportation, so this same need has resulted in a further progress which should be hailed as ultimately providing a swifter and more convenient means of transporting passengers as well as mail from outlying airports to their destination.

Although the roof of the Philadelphia Post Office is only 280 feet wide, east to west, by 350 feet north and south, and has two 27 foot obstructions running

(*Continued on page 72*)

Mr. Pitcairn (left) is a firm believer in the windmill type.

A New Aircraft Plotter Developed

by P. V. H. WEEMS,
Lieut. Commander, U. S. Navy, Retired.

An article in which this distinguished authority on navigation describes a method of chart calculations by which much labor can be saved.

AVIGATION or aerial navigation, which ever term you choose to use, comprises a method by which the course of an aircraft and its position can be determined. This can be accomplished by laborious "hand-power" calculations or more simply, and with less likelihood of error, by the chart method described here. Thus, chart navigation requires two principal operations:

1. Laying the courses.
2. Measuring the distances.

In the past, protractors, parallel rulers and dividers have been used to accomplish these operations. For air navigators one device, combining the functions of dividers, protractor and parallel rulers is needed. The Department of Commerce Type Aircraft Plotter was designed for the purpose, and especially for use with the Department of Commerce Sectional Air Maps, using scales: 1:500,000 and 1:1,000,000.

The new sectional air maps are constructed on the Lambert Projection with the latitude lines appearing as arcs of circles, and longitude lines which converge toward the poles. Since the meridians are not parallel, and since a compass course cuts successive meridians at the same angle, to be exact, course angles must be measured from the local meridians. For example, in Fig. 1, it is clearly shown that the course angle at the starting point is smaller than the course angle at the destination.

The Mark I type plotter was designed for use with the Mercator chart on which the meridians are parallel. In that type the courses are measured from any meridian, and the distances are measured from the center along a distance scale extending in one direction only.

For practical purpose, the mid-meridian course is used on the Lambert Projection map, this course being the average course. Commander K. T. Adams and Mr. J. C. Lyon of the U. S. Coast and Geodetic Survey suggested that the plotter be re-designed so that the course may be measured conveniently at the mid-meridian. In addition to suggesting the changes the personnel of the U. S. Coast and Geodetic Survey assisted in designing and prepared the drawings for the new type plotter.

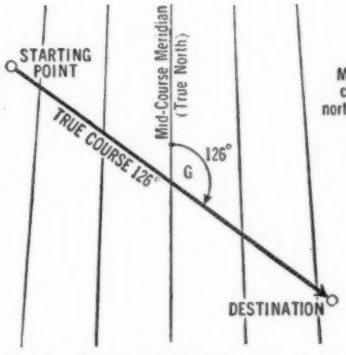


Fig. 1. For an easterly course, angle (G) gives the true course.

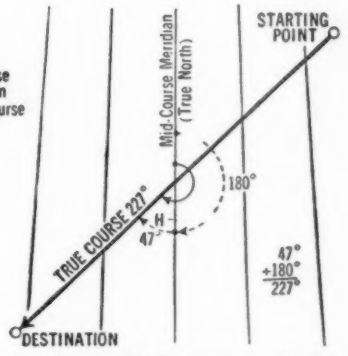


Fig. 2. For a westerly course, angle (H), plus 180°, gives the true course.

The Mark II plotter is so designed that when the protractor edge lies along the course or bearing the angle may be read from the meridian directly above the center. If meridians are not shown on the map, the north reference point must first be determined by orienting the plotter at right angles to the latitude lines.

Fig. 3 shows the plotter in the normal position for measuring east-west courses and distances. The outer semi-circle is used for easterly courses and the inner semi-circle for westerly courses. To facilitate measuring distances along the course, the distance scale on the protractor side of the plotter has zero at the center with distance scales extending in both directions along the course line. Since it now appears that the international millionth scale will be the one most used in the future, this scale is placed nearest the edge. For use with the 1:500,000 scale maps, a separate scale for these maps is placed inside the 1:1,000,000.

In practice the course line is usually laid down by connecting the point of departure and the destination with the straight edge and drawing a line between the two points. The most common use of the plotter is to measure the course angles and distances along the course line. To measure the course place a pencil point on the course line to steady the plotter while its edge is placed along the course with the center on the proper meridian.

When the distance extends across more than about four degrees of longitude, the total distance should be divided into legs of approximately four degrees, using the mid-meridian of each leg for laying the courses.

The plotter scales will conform to the scales of the Sectional Air Maps, and may be used conveniently with scales which are multiples of 500,000 or 1,000,000. For example the plotter scales may readily be used with maps on the scale of 1:10,000,000; 1:100,000; or 1:5,000,000; etc.

For plotting lines of position and for practice problems with this type plotter *Universal Plotting Sheet* with scale 1:1,000,000 has been designed on the principle of the Mercator projection.

END.

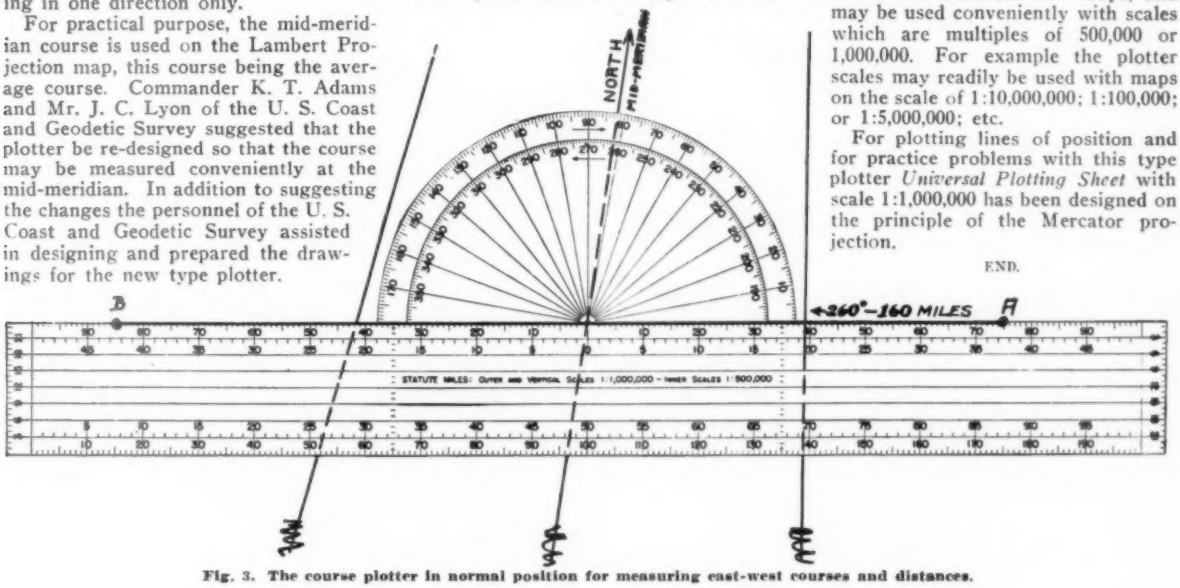


Fig. 3. The course plotter in normal position for measuring east-west courses and distances.

Log of the Explorer II.

IN the following table is the tentative log of the stratospheric flight made by the Explorer II, November 11, 1935, from Rapid City, S. D. The altitudes given are computed from aneroid barometric readings and are subject to final corrections by the U. S. Bureau of Standards.

The inflation began on November 10, at 8:30 p.m., and at 11:45 p.m., a 20-foot rip appeared in the lower portion of the envelope. This was soon patched and the inflation continued. At 8:00 a.m., November 11, the sphere was lashed to the balloon and the take-off took place.

8:00 a.m. Sunup. Take-off.
8:15 a.m. Elevation 11,700 feet.
10:07 a.m. At 21,000 feet over Niobara River, Nebraska.
10:25 a.m. At 28,000 feet and rising at the rate of 500 feet per minute. Outside temperature —40° F.
11:17 a.m. At an altitude of 55,000 feet, 15,000 feet above the beginning of the stratosphere.
11:28 a.m. Altitude 60,000 feet.
11:55 a.m. Altitude about 71,000 feet, the unofficial American record.
12:10 p.m. Altitude estimated at 73,000 feet. Barometric pressure 29 m.m.
12:30 p.m. Peak altitude 74,000 feet. Barometric pressure 27.5 m.m. Outside temperature —78° F.
1:05 p.m. Start descent.
2:47 p.m. Down to 40,000 feet. Located 75 miles east of Valentine, Nebraska.
3:13 p.m. Altitude 31,000 feet and descending 500 feet per minute. About 50 miles west of Yankton, S. D.
3:28 p.m. Altitude 23,000 feet. Discharging ballast to check the excessively rapid descent.
4:13 p.m. Landed safely near White Lake, S. D.

One Year Mechanic's Course at Lincoln

A ONE year airplane and engine mechanic's course has just been announced by the Lincoln Airplane and Flying School. This is a government approved course of great merit.

Much new equipment has been added recently which includes a group of modern airplane engines such as a Wasp, Cyclone, Whirlwind, Velie and a new Packard Aircraft Diesel engine. It is interesting to note that the Lincoln school has held a government approval as a transport flight school since 1930.

U. S. A. A. C. Changes Body Colors

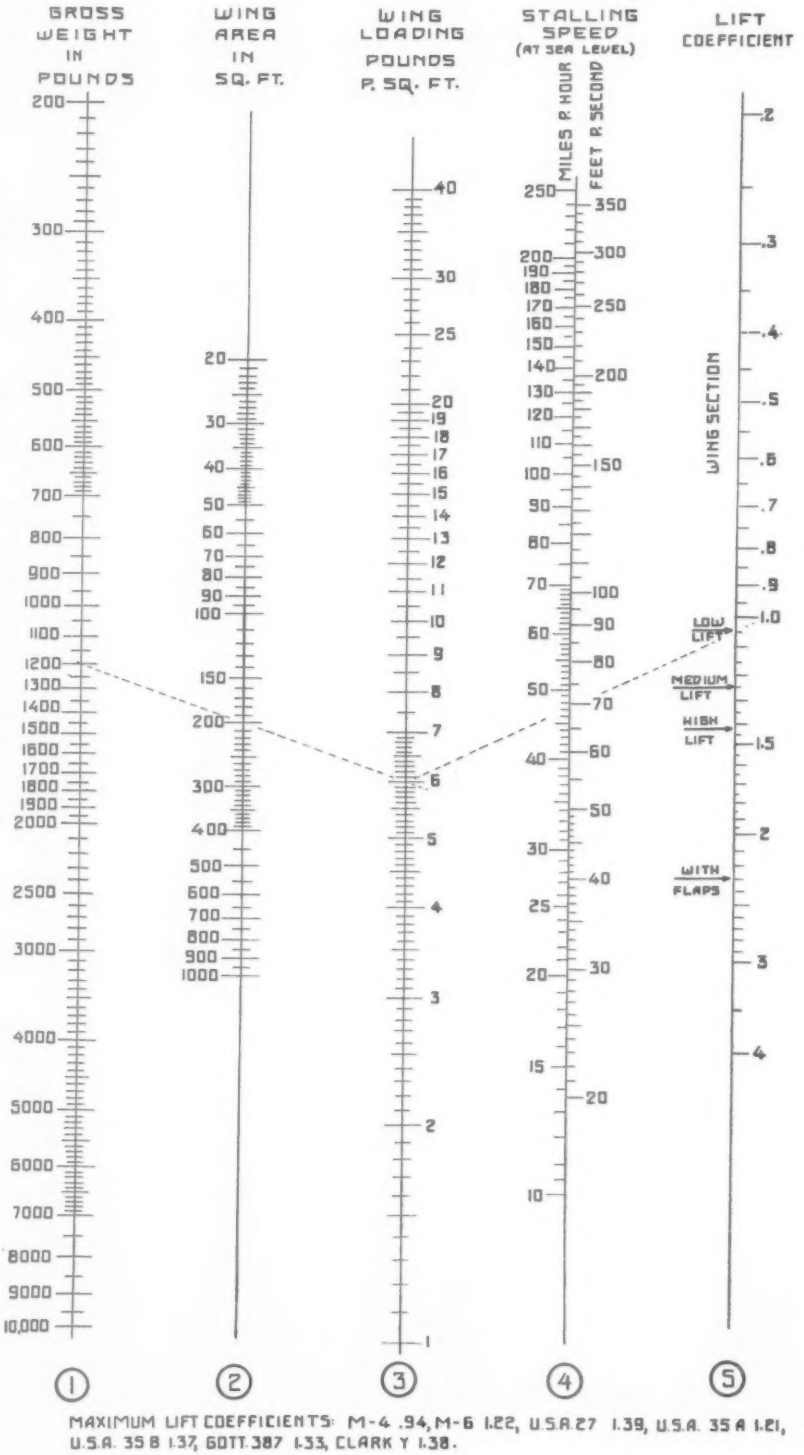
THE fuselage of U. S. Army Air Corps ships are being painted blue instead of the former olive-drab color. We wonder why? In the beginning, any old color was admissable with the wings either clear, natural or olive drab.

A Nomograph for Stalling Speed

by RAOUL J. HOFFMAN

IN THIS chart, the relation between gross-weight, wing area, loading, stalling speed and the lift coefficient is shown. The dotted lines show that a wing loading of 6-pounds per square foot and a coefficient of 1.05, that a stalling speed of 48 m.p.h. can be anticipated.

With the same loading, and a gross-weight of 1,200 pounds, the required wing area will be 200 square feet.



MAXIMUM LIFT COEFFICIENTS: M-4 .94, M-6 1.22, U.S.A. 27 1.39, U.S.A. 35 A 1.21, U.S.A. 35 B 1.37, GOTT. 387 1.33, CLARK Y 1.38.

Soaring Here and There

by SPEED WESTPHAL

"Speed" has a lot of interesting information for our glider enthusiasts in this article, particularly in respect to glider regulations and laws.

HERE is some interesting news from Russia. A new World's record for a non-stop distance flight by an air train was made when a plane and a glider landed at Koktebel, Crimea, U.S.S.R., after an 837 mile hop from Moscow, Russia.

The flight took ten hours and the plane had to be refueled in the air. This was accomplished with the aid of rubber tubes which connected special tanks in the wings of the glider with those of the airplane. The plane carried a crew of three and the glider one.

The previous record, also made by a Soviet plane, which during the last year flew 607 miles non-stop. I always like to hear of these things, but personally I don't know what they prove, except that the airplane was a good one and the glider pilot had a good strong back.

Some time ago I received a letter from Mr. Fred C. Macdonald, President of the Auckland Gliding Club, Auckland C.1., New Zealand. Mr. Macdonald tells me some very interesting things concerning the situation over there, among them being that there are no rules or regulations governing the construction or flying of gliders and sailplanes. That's the part of the letter that brings tears to my eyes.

I haven't discovered what started the soaring boom over in Russia. One thing I do know, however, is that they hired a lot of Americans to go over there on the five year plan. As things stand at present, it looks like it wouldn't be a bad idea to have a few Russians come over here on a five year plan of our own.

Four years ago the Bureau of Air Commerce was apparently against the so-called lightplane, while today they are carrying on extensive experiments with the "under-a-thousand dollar-class." I for one, would like to know just what changed their feelings.

A primary glider just after take-off. Given suitable terrain and weather conditions, this is the sport of kings.

The regulations regarding glider licenses is also one that makes us sit up and think. The rules state that any glider constructed before Jan. 1st of 1932, is eligible for a Federal license. What I would like to know is, what is the difference between those manufactured before that date and those of present day construction. Personally, I have seen a lot better jobs that have been designed and constructed since the year of 1932.

Many hundreds of you readers have written in to me during the past several months, asking that I print an open letter to the Department of Commerce. Here is the letter.

Major J. Carroll Cone, Assistant Director
Department of Commerce,
Bureau of Air Commerce,
Washington, D. C.
Dear Major Cone:

May I suggest a few modifications in the present rules and regulations which govern gliders and gliding? These alterations are based on my recent survey of the gliding situation in this Country today and are as follows.

Because of the great expense involved in the construction of a glider for A.T.C. tests, I suggest an H. B. (home-builder's) license. Said license to be available to all home-builders, regardless of design or construction. As for requirements for this license, I believe the following would be suitable. (1) Said glider must be constructed entirely of aircraft materials. (2) It must be of the single passenger type and fly at speeds not to exceed 30 M.P.H. (3) Said glider must be constructed under the supervision of a licensed mechanic, who will make out a full inspection sheet and mail same to the Bureau of Air Commerce.

I suggest the above only because many gliders and sailplanes are constructed by groups who are located many miles from any airport and far from the offices of Supervising Aeronautical Inspectors. Surely these many groups have a right to do some gliding and are willing to cooperate with the Bureau 100 percent.

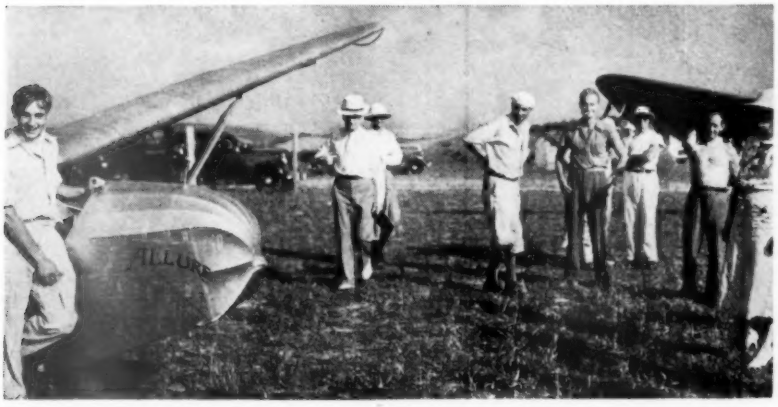
Many licensed mechanics are now out of work and would surely appreciate the additional revenue received from such work. I feel certain that no licensed mechanic would jeopardize his own reputation by allowing a poorly constructed glider to pass the test. One must realize that gliders are not like airplanes. They are never flown at great speeds, nor are they ever flown over Cities or congested areas.

With these points in mind I believe the existing rules governing the license problems are a bit too strict. In closing, I wish to inform you that all of the many hundreds who have written in to me during my survey, have only the highest regard for the Bureau and feel that the interference of State Bureaus are responsible for most of our trouble.

Sincerely, Speed Westphal.

Well, there it is, boys, and I hope it solves the problem. One thing I'm sure of. If we don't get this type of license soon, we might just as well sit back in our easy-chair and content ourselves by reading of the progress made in Germany, Russia, New Zealand and China.

(*Concluded on page 65*)



In the foreground is Ted Beliak with his soaring plane. This ship is well supplied with instruments for cloud-hopping and is highly efficient. Richard DuPont (with cigarette) is in the background.

This Kimona for Less Than $100

by BILL BARTLETT

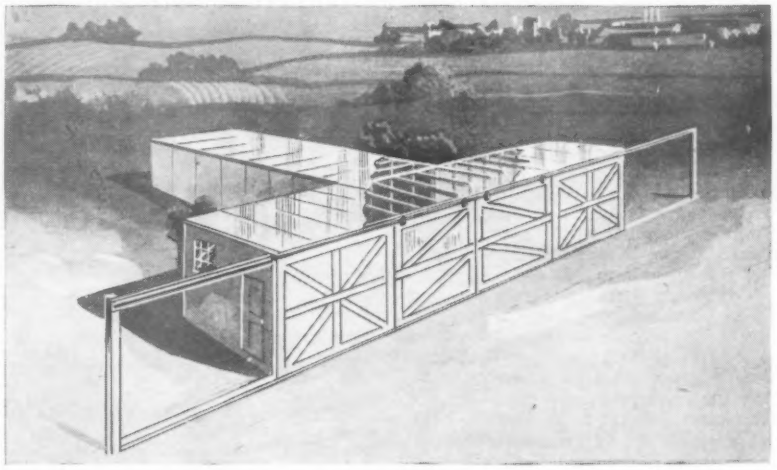
Is this simple hangar for lightplanes the answer to the homebuilder's dream? Well, read the article, look at the drawings and figure the matter out for yourself. If you know of something better, don't keep it to yourself.

NO doubt this is just exactly what you and the Emperor Haile Selassi, of Ethiopia, have been waiting and praying for—a weatherproof, form-fitting steel nightgown for your own little sky perambulator.

It can be constructed for slightly under $100.00—and this is sure to knock you right out of your high-chair—even if you have to buy all materials brand new.

Interested? I thought so. Come on along and when we're finished, you'll not only have a hangar that will stand until Mussolini loses his ambition, but after scrimping through this welter of facts and figures with me, you'll come out a combination of Einstein, a nervous invalid, and a building contractor. The pawnshop keeper, with whom you soaked your wristwatch and goggles just before Christmas last year, will greet you with open arms.

Like Mae West, an airplane hangar is of no account unless it has a good foundation. Although I have economized on several phases of the construction, the framework is built with a more-than-ample margin of strength. I love my little aerial blow-buggy and I don't want the shed to fold up like an accordion in the first Spring zephyr.



Here she is, the $100.00 airplane stable in all her glory, wind-sock and everything. Ye amateur may have a little struggle with the doors, now and again, but that happens with the best of regulated hangars.

PARTS AND COST SHEET

Metal (28 gauge, 2′ wide, 2 V-crimp, painted.)

Sides of Front,	8 sheets, 8′ long, @ 45c		$3.60
Rear, First,	14 sheets, 8′ long, @ 45c		6.30
Sides of Rear,	18 sheets, 7′ long, @ 39c		7.02
Rear, Second,	4 sheets, 6′ long, @ 34c		1.36
Roof of Front,	18 sheets, 9′ long, @ 50c		9.00
Roof of Rear,	8 sheets, 9′ long, @ 50c		4.00
Total			$31.28

Wood (All oak, except door frames poplar.)

70 Feet 6″x6″ sills	210	board ft.	
70 Feet 2″x6″ sills	70	board ft.	
35 Feet 2″x4″ sills	24	board ft.	
6 8′x6″x6″ corner posts	144	board ft.	
2 6′x6″x6″ corner posts	36	board ft.	
22 8′x2″x4″ studding	118	board ft.	
17 8′x2″x4″ studding	92	board ft.	
4 6′x2″x4″ studding	16	board ft.	
3 55′x2″x6″ for door track	165	board ft.	
2 8′x2″x6″ for plates	16	board ft.	
1 35′x2″x6″ for plates	35	board ft.	
2 17′x2″x6″ for plates	34	board ft.	
1 8′x2″x6″ for plates	8	board ft.	
3 26′x2″x4″ rafter	52	board ft.	
14 9′x2″x4″ rafter	84	board ft.	
4 13′x1″x6″ door frame	26	board ft.	
2 8′x1″x6″ door frame	8	board ft.	
2 10′x1″x6″ door frame	10	board ft.	
2 8′x1″x6″ door frame	8	board ft.	
2 10′x1″x6″ door frame	10	board ft.	
4 9′x1″x6″ door frame	18	board ft.	
2 8′x1″x6″ door frame	8	board ft.	
4 8′x1″x6″ door frame	16	board ft.	
4 10′x1″x6″ door frame	20	board ft.	
Total, @ $3.00 per 100	1228	board ft.	36.75

Miscellaneous

9 sheets ¼″ plywood, 4′x8′, @ $1.20	10.80
3 47″x28″ barn windows @ 1.50	4.50
2 sets door hangers, 36 feet track	5.10
2 pr. 14″ hinges, @ 50c; 20 lbs. roofing nails, $2.60; 20 lbs. 20d nails, @ 4c; 2 gal. aluminum paint, @ $2.98; 10 lbs. 3d nails, @ 4c; 2 foot bolts, @ 28c	11.32
Grand total	$99.75

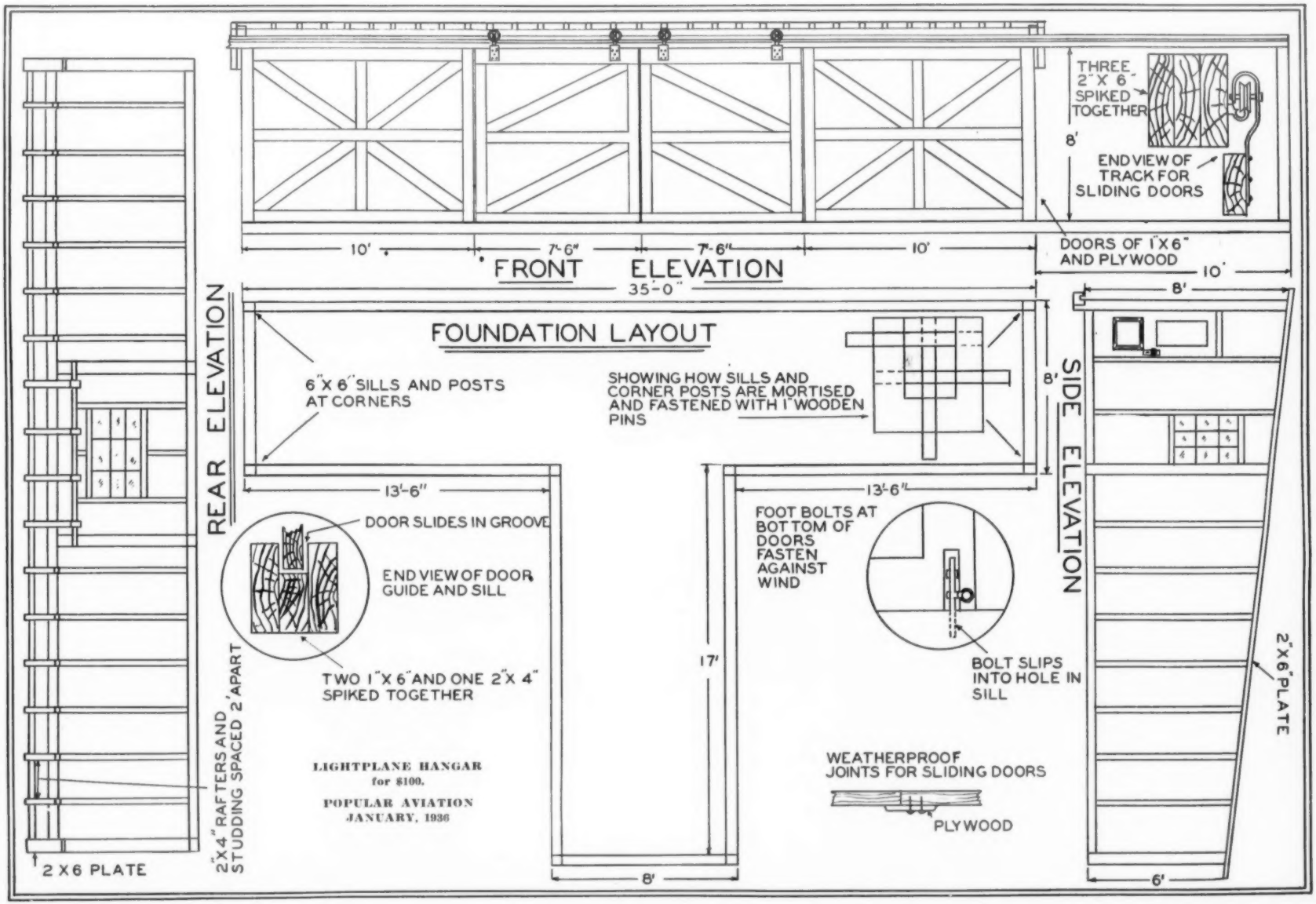
All foundation timbers and corner posts are of 6″x6″ hardwood, preferably oak. The combination front sill and door-guide is made up of two 2″x6″ planks, one on either side of a 2″x4″ plank, all 35 feet in length. While the sills and corner posts may be fastened together with spikes, I took a tip from the construction of the old barn down on the farm and made mortise and pin-joints as shown in the drawings.

The drawings show how the shed is tailored around the plane—for economy of building materials. The dimensions are merely suggested, as being large enough for the average lightplane. However, the simplicity of design allows plenty of latitude for alterations to suit your own ship.

Plates, size 2″x6″, are nailed to the tops of all corner posts at all sides except the front. Here, the plate must also act as a support for the two sliding doors and is built up of three 2″x6″ laminations, spiked together. Each of these three planks is 55′ long, allowing an extension of ten feet to either side of the building, so that the doors slide completely out of the way when wheeling out the ship. The ends of this track support rest on strong posts set into the ground.

Studding stock is 2″x4″ oak, as are the rafters, and all are spaced 2 feet,

(*Continued on page* 40)


THREE 2"X 6" SPIKED TOGETHER
8'
END VIEW OF TRACK FOR SLIDING DOORS
10'
7'-6"
7'-6"
10'
FRONT ELEVATION
DOORS OF 1"X6" AND PLYWOOD
10'
35'-0"
8'
FOUNDATION LAYOUT
6"X 6" SILLS AND POSTS AT CORNERS
SHOWING HOW SILLS AND CORNER POSTS ARE MORTISED AND FASTENED WITH 1" WOODEN PINS
8'
SIDE ELEVATION
REAR ELEVATION
13'-6"
13'-6"
DOOR SLIDES IN GROOVE
END VIEW OF DOOR GUIDE AND SILL
FOOT BOLTS AT BOTTOM OF DOORS FASTEN AGAINST WIND
TWO 1"X 6" AND ONE 2"X 4" SPIKED TOGETHER
17'
BOLT SLIPS INTO HOLE IN SILL
2"X6" PLATE
2"X4" RAFTERS AND STUDDING SPACED 2' APART
LIGHTPLANE HANGAR for $100.
POPULAR AVIATION JANUARY, 1936
WEATHERPROOF JOINTS FOR SLIDING DOORS
PLYWOOD
2 X 6 PLATE
8'
6'

Hangar

(*Concluded from page 38*)

making it possible to nail the siding directly onto them without sheathing. Notice that provision is made for an auxiliary door for entry at one side. This precludes the necessity of opening the main doors when the wind is strong and they are likely to come to grief.

Frames of 2"x4" are also constructed to receive the 47"x28" window sashes, of which there are three—one at either side, shedding light on cockpit, engine and wing, and one at the rear, lighting the empennage.

I'll admit that the problem of economical illumination had me behind the eight-ball for a while, but then I thumbed at random through a Farmer's Bible (mail order catalogue to youse sophisticated city slickers) and found something that brushed the bitter tears from my eyes and took the bad taste from my mouth.

Barn windows, glazed and complete, measuring 47"x28" for only a buck and a half. Three of these will suffice to give all the light you need for those rainy day tuning-up jobs.

Then, too, since the window has nine sections instead of one, the maintenance cost is lower, for when you get sore and throw the fire-extinguisher at that student pilot who just won't quit ground-loopin' the ship, there'll only be one new panel to buy, instead of the whole pane.

Now about the foundation. You can buy all new lumber at the current prevailing price and still come out this side of the one-hundred-what-it-takes mark. But if you can get used timbers, the money saved will buy that new air-speed you've been wanting.

So just cast an eye about. There's old Uncle Abner who owns that old tumble-down barn out in the country, and derned if he wouldn't be glad to git rid o' the pesky thing! Yessir, and thar's a passel o' swell framin' timbers in them thar old barns, Pardner. Look it over, and if it contains what you want, offer him anything up to twenty bucks for it. Or, if the farmers in your vicinity, forget sometimes to take their trees in at night, you might even make a frame a la Nature in the Raw from logs.

For the city guy, who eats with a fork instead of his fingers, there is the railway yard where they tear obsolete freight cars from limb to limb. You'll find that there is some dandy lumber in these old veterans of the road. Or try for what you want at some wrecking company in your city. These are the ideas. All I can add is that any guy who can't keep his eyes open and pick up the framing timbers at a real saving ought to be painted pink with diluted mercurochrome and sent to a nudist's colony.

All the walls, with the exception of the front, are made of 28 gauge painted steel siding. The higher cost of galvanized siding makes its use prohibitive.

(*Concluded on page 66*)

A Pou du Ciel Lined Up With Douglas

This photo proves without a doubt that the Sky Louse is considerably smaller than the Douglas DC-2 transport.

AT the Bordeaux (France) airport, our French correspondent caught an interesting picture of a Sky Louse huddling up under a giant Douglas DC-2. The Douglas ship belongs to the Spanish L.A.P.E. airline, while the louse is the property of the designer, M. Henri Mignet.

It is said that more than six-hundred of the little ships are now under construction by the amateurs of France, to promote the cause of economical flying. The French government is evidently much more lenient with the amateur than the Bureau of Air Commerce to permit such widespread amateur activities.

We have not been informed as to the government subsidy on homebuilt planes in France, or whether the French government contributes half the cost of a homebuilt ship as it does in the case of a commercial lightplane, but to judge from the constructional activities in France it is very likely that the government at least contributes something to the game.

The Aero-Sportswoman

by JOAN THOMAS

THE rules and regulations for the French *brevet et licence de pilot de tourisme* (private pilot's license) are very simple compared to those of the Department of Commerce, with which all of you are so familiar. And we think that the Aero-Club de France may be the private flyer's dream of freedom from government red tape, as it seems to have jurisdiction over all civil flying.

When we first began our investigations regarding flying conditions under the tricolor, one enthusiastic student told us that all one had to do to qualify for a license was to fly one hour solo . . . apparently it didn't matter whether you had any dual-instruction or not! However, after a bit more research on the subject we found that it isn't quite as easy as that, though the requirements do seem to be at the minimum possible.

Under the rules of the Aero-Club de France, for a brevet of the first degree, the candidate must be at least seventeen years of age and present the usual medical certificate. He must have flown 15 hours, which time may include his dual instruction, providing he has made at least 30 solo landings. The actual flight test is just as simple. He is required to make one landing from 2000 feet and to do a series of five figure 8s at an altitude of approximately 600 feet.

There are, of course, the usual instructions about landing the ship within five hundred feet of a mark, and not gaining or losing altitude on the eights. The technical examination includes the ordinary airport rules and regulations and a practical knowledge of aerial legislation.

According to the regulations, established in 1933, to secure a license of the second degree (there are only two civil ratings), the pilot was required to fly approximately 1800 miles cross-country, during which time he had to make at least 50 landings at eight different airports. In addition he had to make two separate trips of more than 300 miles on different days, with not more than one stop enroute each day.

But, apparently even these requirements were too much for the frugal Frenchmen, or it may have been simply their zeal to further encourage the private flyer, for in 1934 these regulations were changed. To secure the second degree license now, a pilot only needs to fly an additional 15 hours, that is over and above the fifteen required for

(*Concluded on page 67*)

Belt-Drive for Lightplanes

by S. R. WINTERS

Results of the experiments made with belt-driven propellers under the auspices of the Bureau of Air Commerce. This is full of interest to the lightplane fan who is often faced with power transmission problems.

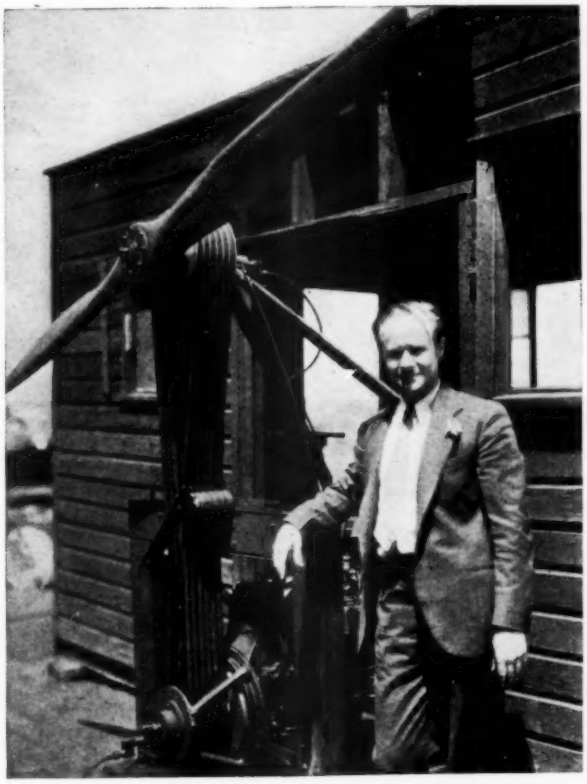
THE number of privately owned aircraft might be greatly increased if the possibility of using the belt-drive in airplanes is developed.

As the result of investigations performed by the Casey Jones School of Aeronautics, it is believed that V-belts and pulleys will provide a safe and efficient drive for airplanes, and that they will also be economical in test, upkeep and operation of engines up to 120-horsepower.

The Bureau of Air Commerce contracted with the Casey Jones School to determine if an automobile engine would satisfactorily drive a propeller through the medium of a V-belt drive for 300 hours. The trial was made on the ground and a well-known type of 6-cylinder automobile engine was used. The engine was connected by six belts with an airplane propeller.

The preliminary runs showed that the motor would run for a short length of time on one belt. There was excessive slippage, however, and a great deal of wear on the belt. When six matched belts were used, the slippage came down to approximately three to 4-percent., and so it was decided to make the 300-hour endurance test with six belts.

Operating rather than laboratory conditions existed while the experiment was being performed. The propeller revolved about 10 feet in front of the hangar wall where it was continually influenced by a great deal of dust and dirt blowing in from the airport. Little effort was made by the helpers to keep the apparatus clean inasmuch as the test conditions were to be as difficult as possible.



The belt-driven propeller in place on the test-stand where the drive was given a grueling run with an automobile engine as the powerplant.

Excessive heat and severe rainstorms were experienced during the period of the test from May 29 until July 20. No effort was made to keep the sun from shining directly upon the engine and belts, although the temperature reached 96° F. at times. After the 300-hour run the engine was completely torn down and inspected. The pistons were in good condition, the cylinder walls showed hardly any wear, the camshaft bearings were tight and the crankshaft was fine.

The main bearings were in good condition, but the connecting-rod bearings were only fair. These bearings required replacement as the babbitt had started to chip away from the connecting rod. About 30-hours before the completion of the run, this chipping action was indicated by flakes of metal in the oil. The valve seats did not indicate wear, and the valves, with regrinding, could continue running. The price of the valves is 40 cents each. Any repair station equipped to work on engines of this type could replace the complete set of connecting rods with bearings for $30.60. The main bearings could be replaced for $15.00, which is a very low figure.

The life of the belts was at least 300 hours and they would probably last several hundred hours longer. No wear was shown on the belts until the last part of the run. Then, certain places on the outside layer of fabric had worn away, but the second layer of fabric had not been damaged.

Inspection of the belts was made easy due to their construction. The belts failed from the outside in, so it was simple to see when they were approaching the danger point. They could be changed easily, therefore, before the breakage point was reached.

For engines of 75 to 100-horsepower six belts are recommended. The amount of slippage decreases as the number of belts is increased. With six belts on the 100-horsepower engine the slippage is about only 3-percent. With engines of lower horsepower fewer belts could be used.

The original duralumin lower pulley used in the test wore very quickly. A steel sleeve was shrunk over the duralumin and, at the end of the trial, the steel pulley showed no sign of wear. Although the upper duralumin pulley did not indicate wear until the last part of the run, it is advised that all pulleys used in work of this type be made of steel.

The driving pulley with the belt used, must have a minimum pitch diameter of 5½ inches. The upper pulley must suit the ratio of reduction. If the belts are too long, idlers must be used to stop the lashing.

No change was made in the stock 6-cylinder automobile engine. It was used exactly as it was received from the factory and it functioned perfectly for the 300-hour test. A fiber timing-gear failed at 150 hours, but the engine company had said prior to the test that this gear might fail. It had been redesigned so one of the new gears was installed and it was in fine condition when the test was completed.

The generator, the cut-out, and the spark coil functioned satisfactorily. Several times during rain, a new coil was used to check the old one, but the experiment was completed with the original coil. No trouble was given by the breaker assembly. The points were filed once during the run and they were in good condition at the end. This was not much greater than in normal service.

Due to excessive air temperatures the temperature of the engine rose to 290° F. and sometimes higher at the beginning of the run. An effort to turn more air into the radiator with baffles was not satisfactory. A 50-gallon oil drum was then used and the temperature was regulated by allowing cold water to run into the top of the drum as needed. In this way, the outlet water temperature was maintained at about 160° F. 180° F.

maximum and 140° F. minimum would be recommended on the engine outlet.

Regular automobile oil was used throughout the run. The oiling system consisted of an oil pan holding 5 quarts of oil. The oil was pumped up to both ends of a splasher pan over the oil pan. It then ran to the center of the engine and overflowed back to the bottom of the oil pan. All parts were lubricated by splash.

This oiling system seems to be satisfactory for an airplane inasmuch as several months ago an engine of this type was installed in an airplane and it flew for about 100 hours without any trouble. The engine was equipped with a downdraft carburetor. A fuel pump of the diaphragm type sucked the gasoline from the tank and forced it into the carburetor.

Some difficulty was experienced with an automobile gasoline which contained lead. After 24 hours of operation the engine lost 200 revolutions per minute wide open. When the cylinder head was removed, a white deposit, about one-thirty-second of an inch thick, was found all inside the combustion chamber, and the exhaust valves had a thick brown settlement on the tops. When an aviation gasoline without lead was used, the deposits left, and the engine did not lose revolutions. For the final 200 hours of the test, another automobile gasoline without lead was used and found to be satisfactory.

A standard commercial type propeller was used. It was designed for a 125-horsepower air-cooled aviation engine at 2,050 revolutions per minute.

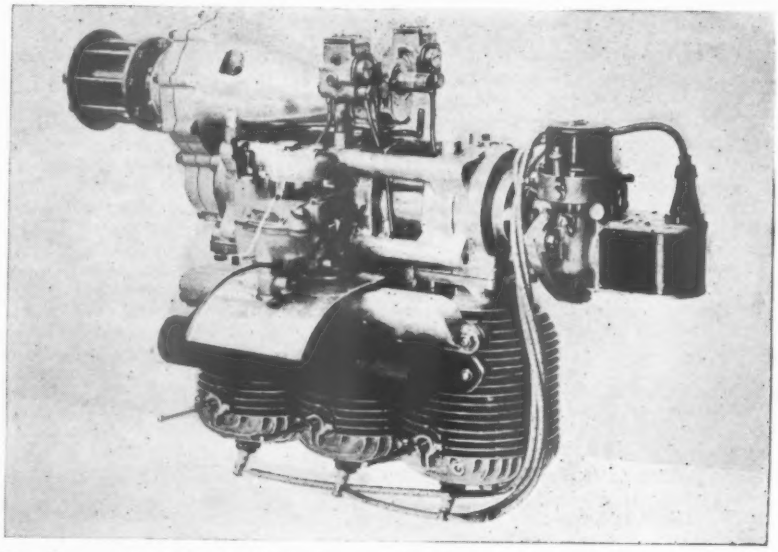
The spark plugs, which were part of the engine's equipment, were all right for ordinary running but burned out after about 30 hours' running at high speed. A cooler-running plug lasted for about 100 hours. Testing of the belt drive showed that belts provide an excellent method of reducing high engine revolutions per minute to effective propeller revolutions per minute. The investigation showed that the operation is efficient and safe.

This was tried years ago by Santos Dumont, Louis Bleriot and others, but it was a failure with the flat leather belts of that day. The present type belt, with its triangular section, was first introduced by Charles Duryea as an automobile drive in the year 1900. It is very difficult to get anything that has not been tried, particularly in transmission systems connecting a gasoline engine with its load. The great problem will be in getting a compact arrangement.

The great advantage of the automobile engine is its economy. A disadvantage, as compared with regular airplane engines, is the heavy weight per horsepower. The advantages for certain purposes, however, might overcome the disadvantages. Many people do not own airplanes because of the initial cost, and the expense of upkeep and operation. A low-priced airplane must have a low-priced engine, and if there is a real demand for such engines, the manufacturers might endeavor to lighten their engines and produce them in sufficient quantity to reduce the prices as well.

END.

Another Aubier-Dunne Lightplane Engine



Rear three-quarters view of the Aubier-Dunne engine showing ignition system, carbureter and lubricating oil pumps.

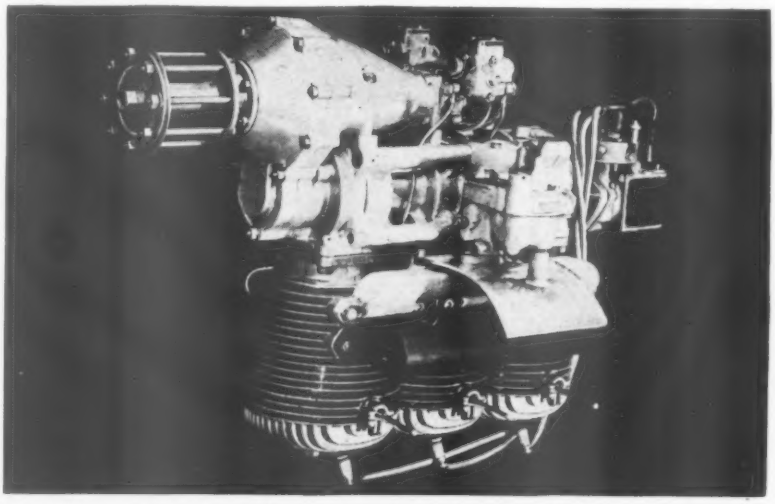
THEY are going after the lightplane in a big way in Europe and are developing a great many engines for these ships.

We show here, the latest French engine creation, the Aubier-Dunne three-cylinder engine, the big brother of the two-cylinder Aubier-Dunne engine described in the September issue of POPULAR AVIATION. As with the former engine, this is an air-cooled two-cycle engine with a cylinder displacement of 324 cubic inches and rated at 27 h.p. running at a normal engine speed of 3,200 r.p.m.

This engine speed is reduced to propeller speed by a 2-to-1 ratio reduction gear so that the normal prop speed is 1,600 r.p.m. Steel liners are used within cast aluminum barrels.

The use of the two-cycle engine grealy assists the lightplane builder because of its simplicity, lower first cost and low cost of maintenance. The late models of two-cycle engines show almost as good economy as those of the four-cycle type, which most certainly was not the case with the early engines. A fuel consumption of 0.55 to 0.65 pound of gasoline per horsepower hour is attained by the two-strokes and this is not bad for any type of engine.

In view of its application to low cost planes, however, it would seem that the propeller gear is rather out of place on such a job as these highly accurate gears must be quite expensive. A little more weight with a slower speed engine would not be out of the way.



Front three-quarters view of the new 3-cylinder Aubier-Dunne lightplane engine showing reduction gear housing.

Book Reviews

THE BOOK OF THE AEROPLANE, by Capt. J. L. Pritchard. 251 pages, cloth bound. Date: Oct. 16, 1935. Published by Longmans, Green & Company, 114 Fifth Avenue, New York, N. Y. Price $2.75.

THIS excellent book, which is now in its third edition, is most heartily recommended for the novice in aviation or for those who wish to brush up on aviation history. Being of English origin, many interesting facts concerning English aviation are discussed that have not received much publicity in America.

It starts from the very beginning with the pre-flight era, then the Wright Brothers, and so on, up to the last minute. It tells in an elementary way how the plane flies, the records that have been made, the various types of airplane and seaplanes, the airplane in the World War and similar topics. It contains many excellent illustrations, many of them from rare old photographs.

* * *

CIVIL AVIATION LAW, by George W. Lupton, Jr. Cloth binding. Date: Nov. 8, 1935. Published by Callaghan & Company, 401 East Ohio St., Chicago, Ill. Price $5.00.

THIS volume presents the law of aviation as developed up to the present time by Acts of Congress, state legislation, treaties, decisions of the courts, law review articles and legal texts. It is most comprehensive in scope, covering such subjects as Federal and State jurisdiction, aircraft as common carriers, airports, Torts by aircraft, liability for torts, insurance, bailments, contracts, mortgages, sales, liens, workmen's compensation, patents, crimes and the airmail.

It is apparent that the book will be of great value to pilots, airport managers, manufacturers and others who are associated with the industry. The sections on bailments, mortgages and liens will make a special appeal to airport managers.

* * *

AVIATION TRAINING. Aeronautics Bulletin No. 19. Paper binding. Date: July 1, 1935. Bureau of Air Commerce, U. S. Department of Commerce. Published by the U. S. Government Printing Offices, Washington, D. C.

THIS is a most remarkably instructive bulletin for the young man about to enter aviation. It tells how licenses are obtained, qualification for different positions, About flying schools, The elements of the airplane, instructions on straight and stunt flying, elements of meteorology and many other subjects.

It is by far the most informative and well illustrated work yet prepared by the government on flight training and, of course, is authentic. It is well worth studying by everyone interested in aviation, whether a student, beginner or seasoned pilot.

(*Concluded on page 52*)

The Praga "1142" Air Baby Lightplane

Entering or leaving the Air Baby presents problems such as lifting the entering edge of the wing, and stretching out a leg toward the wheel.

A NEW lightplane, known as the Praga "1142" Air Baby now being built for fifty private owners and aviation clubs in Europe. This little two-seater lightplane is of the high-wing cantilever type, built completely of wood with a plywood covering. It is built by the Ceskomoravavska Kolben Danek Co., Praha, Tchecoslavaquia.

Both of the side-by-side seats are arranged for back type parachutes and are placed beneath transparent panels so that excellent visibility is had. The leading edge of the wing up to one-third the chord, is hinged so that it can be lifted for entrance or exit from the cabin, the front third of the wing also acting as the cabin roof.

SPECIFICATIONS OF THE PRAGA 1142

Wing span	36′ 0″
Wing area, square feet	152
Chord	4′ 4″
Weight, empty	580 lbs.
Weight, loaded	1030 lbs.
Power-plant	30-40 h.p.
Speed, max.	94 m.p.h.
Rate of climb	410 f.p.m.
Service ceiling	11,000 ft.

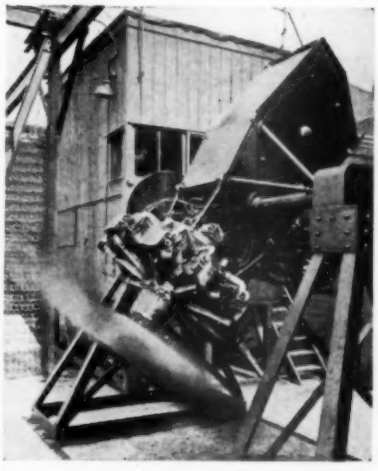
The standard plane is equipped with the Praga 36 h.p. engine, an opposed type with 113 cubic inches displacement. It can also be equipped with other engines of similar type and power.

A Tilting Test-Stand for Engines

IN the test hangars of the Bristol Company, England, is a new type of engine test-stand which permits the engine being tilted during test to simulate diving or climbing positions.

This stiff structural mounting, holding the engine, can be turned through an angle of 180-degrees and can be made to assume vertical or horizontal attitudes as may be required. This change in attitude is useful for testing the effectiveness of the thrust bearings and lubrication system which are sometimes affected by the position of the engine.

All control lines and oil feed lines of the lubricating system are made flexible so that the movement of the engine is unrestricted. Arens cables are used for the controls so that the engine works under actual service conditions. From the test cabin, all of the engine parts can be inspected while in operation and any defects can be removed before the engine is shipped or installed in an airplane.



A Bristol engine on the new test stand with the test stand tilted down, simulating conditions in a dive.

XUM

Building Your Gas-Powered Model

by P. J. SWEENEY

SO MANY model builders make the mistake of trying to build some fancy or elaborate type of model for their first gas powered experiment—and then have a lot of grief and disappointment as a final result.

Let me urge you not to make this mistake yourself but to select a good stable simple design of a high-wing plane that is easy to build. Invariably, this will give the best results as a beginning and then, after you have had some experience, you can build more complicated designs. Start easy and start slow is the best model for the beginner in model gas aeronautics.

For the best results, a slow flying model with light wing loading and good stability is necessary. My first model is shown by the accompanying photographs. It was built one year ago and is still flying, but many changes have been made from time to time. This model has a span of 8-feet and weighs 6.5 pounds. It was both designed and built by the author and no stock plans were used. It flies slowly and is exceptionally stable, two reasons why it is still flying after a year of service.

To attain slow flying, the wing-loading was kept down to 5/6-pounds per square foot or about half the loading employed with many other gas models. The aspect ratio is five and the wing area is 11.48 square feet. With these specifications, the plane can be flown so slowly that there is little likelihood of it being washed out in a rough landing, particularly in the preliminary stages.

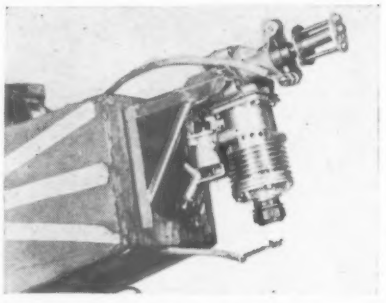
In testing out your model, your first precaution is to avoid a crackup. Give it about 1/16-ounce of gas, and no more, so that it will stay within range. Have one fellow at each wing tip when starting the motor, cut the r.p.m. down, and then run along with it until it takes off. Now let her go and watch the results.

It will climb and then turn down-wind, if everything is all right, and when the gas gives out, will come in on a nice flat glide until it lands. She will circle steadily, or should, until the motor conks.

However, if there is too much torque, it will start to circle and come in at the same time, ending with one of the wing tips hitting the ground—and how it hits! However, with the limited amount of gas specified, the motor will quit before she hits the ground, and she will come in flat because there is no longer any torque.

The space available does not permit me to go into a lot of constructional details at the present time, but I must remark that the design and construction of the propeller is one of the most important items connected with the model. In a future issue I will take this propeller design matter up in full detail so that you fellows will avoid the grief that I ran into on my first attempt.

The Sweeney gas model taking off on the grounds of the Edward Hines hospital. Col. Hugh Scott has given his permission to use this field as a model airport.



The motor inverted, mounted at the front of the Sweeney model.

Mr. P. J. Sweeney and his model which, you will note, has "POPULAR AVIATION" neatly printed on the sides.

The first step to take is to get your motor and learn how to operate it. Make a careful study of the instructions that come with the motor, and then build your plane around this powerplant. These little motors are usually very temperamental and will provide plenty of worry if they are not handled in the right way. But, remember, all of the trouble with a motor cannot be charged to the motor—the owner himself is to blame many times.

Remember that the motor is very small and therefore that the amount of fuel going into it is small. A very little gasoline is required for the mixture and the majority of fellows make their mistake by flooding the carbureter. Run your engine "on the block" or attached to some solid object before it is installed in the plane so that you can experiment without damage and learn how to operate the little fellow before it is finally located.

As with early automobiles, ignition trouble is one of the most common sources of worry. The wiring must be done perfectly, all joints soldered and the wiring protected so that the spark will jump through the plug and not to some metal part before it gets to the plug. Test the batteries frequently for they often die quickly and without warning. Again, the spark plug will often become fouled and will require cleaning before the motor will run efficiently—or at all for that matter.

If you have worked for a long time without getting a "sput" out of your motor, it's a ten-to-one bet that the batteries are dead, that the wiring is broken or disconnected or that the gasoline line is clogged. Nothing can go wrong inside the motor, so don't open it. Dissembling the motor will probably add some more to your worries. Watch these points: battery, wiring, gasoline, spark-plug points and mixture adjustment.

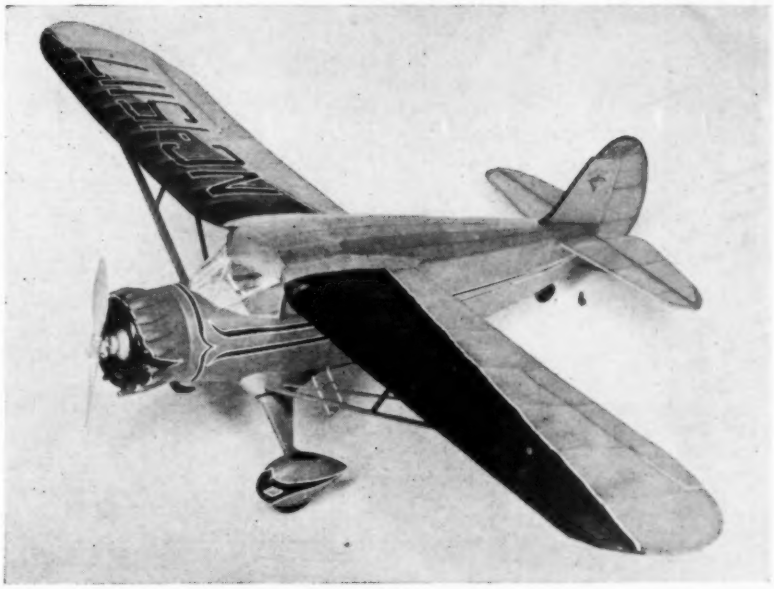
There is nothing to equal high-test gasoline as a motor fuel although there will be plenty of fellows advocating benzine, cigaret lighter fluid, ether and all the rest of it. But in the long run, gas is the best. Stay away from ether, even if it does start quickly. It's dangerous in the engine and out of it.

A number of fellows have asked me how I inverted the motor shown last month and what extra parts were used. No extra parts were employed, the only thing done was to remove the needle valve and turn it over. Nothing else is necessary except to note that the motor must be right-side-up when it is being started. When inverted, the spark-plug fouls faster than in the other position, but that is about the only trouble that you will experience.

Building the Stinson SR-6

by PAUL W. LINDBERG
Model editor and designer for
POPULAR AVIATION

THIS is one of the most popular of full-size cabin ships and it is also extremely popular with the model builders. If a great deal of patience is worked into the model, you will be well repaid for your efforts. The model is equipped with aluminum hinges which carry movable controls, shock absorbing landing-gear and many other interesting features all of which were developed by our laboratory.



True to life is this model of the Stinson SR-6. It is difficult to tell whether we are looking at a photo of the original or a model.

COLOR SCHEME

Fuselage and rudder. Dark red with blue stripes and white trim. Wing panels. Blue and red with white trim. Details. Black and silver.

CONSTRUCTION OF FUSELAGE

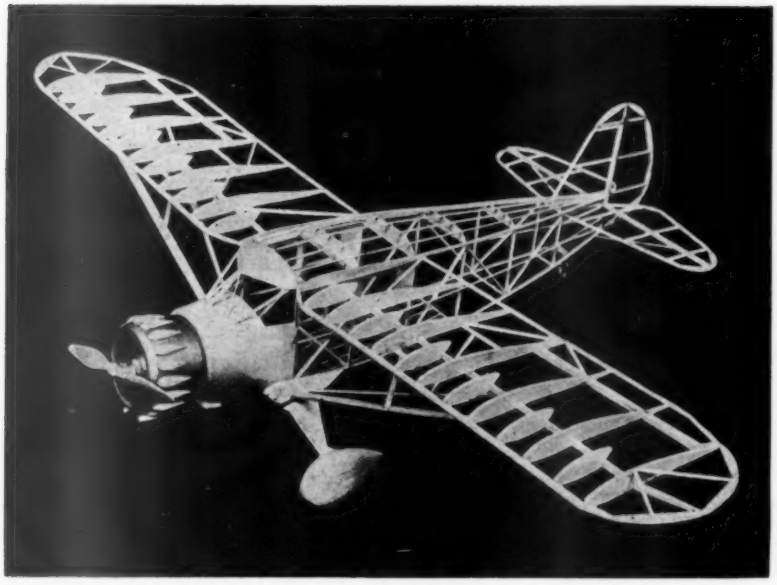
First, place waxed paper on top of plan to prevent parts from sticking to it. The fuselage sides are built from 1/16-inch square balsa. The longerons, verticals, diagonal braces, etc., are held in place until securely cemented. This is done by inserting straight pins on either side of strips wherever needed. When the two sides are completed, the cross-members are cemented into their proper locations.

Cut the formers from sheet balsa and cement them in their respective positions. With exception of the top and bottom stringers, a single stringer is required on both sides of fuselage. See plan.

Stiff paper is required between the ⅛-inch thick balsa nose-plate and the formers 6—7 and 10. A single piece of stiff paper is needed on both sides between formers 10 (top and bottom longeron) and a point designated by arrow. Bottom of fuselage is covered with tissue.

CONSTRUCTION OF MOTOR

The cylinders are carved and sanded from balsa blocks. When nine cylinders have been formed, wind heavy thread around them to represent fins. Make crankcase from two pieces of balsa. Rocker-arm housings, push-rods and other small details of motor are made of balsa.



This view of the skeleton of the model Stinson SR-6 will be of assistance in getting a full understanding of the drawings.

CONSTRUCTION OF WING

Cut all ribs from 1/16-inch balsa. Pin the spar in position on the plan. Now, cement ribs in their proper locations. The leading and trailing edges are cut and sanded to shape and cemented to the ribs. The panels carry movable ailerons which are a great help in controlling the flights. Make wing tips from 1/16-inch thick balsa. We highly approve of this type of wing tip, because it is much easier to construct and neater in appearance.

To obtain the correct angle between rib C and wing tip, the wing spar and leading and trailing edges must be cut at rib C.

CONSTRUCTION OF ELEVATOR AND RUDDER

These parts are built from 1/16-inch square and flat balsa and are constructed on the plan. Their construction is very simple, therefore, no difficulty should be encountered here.

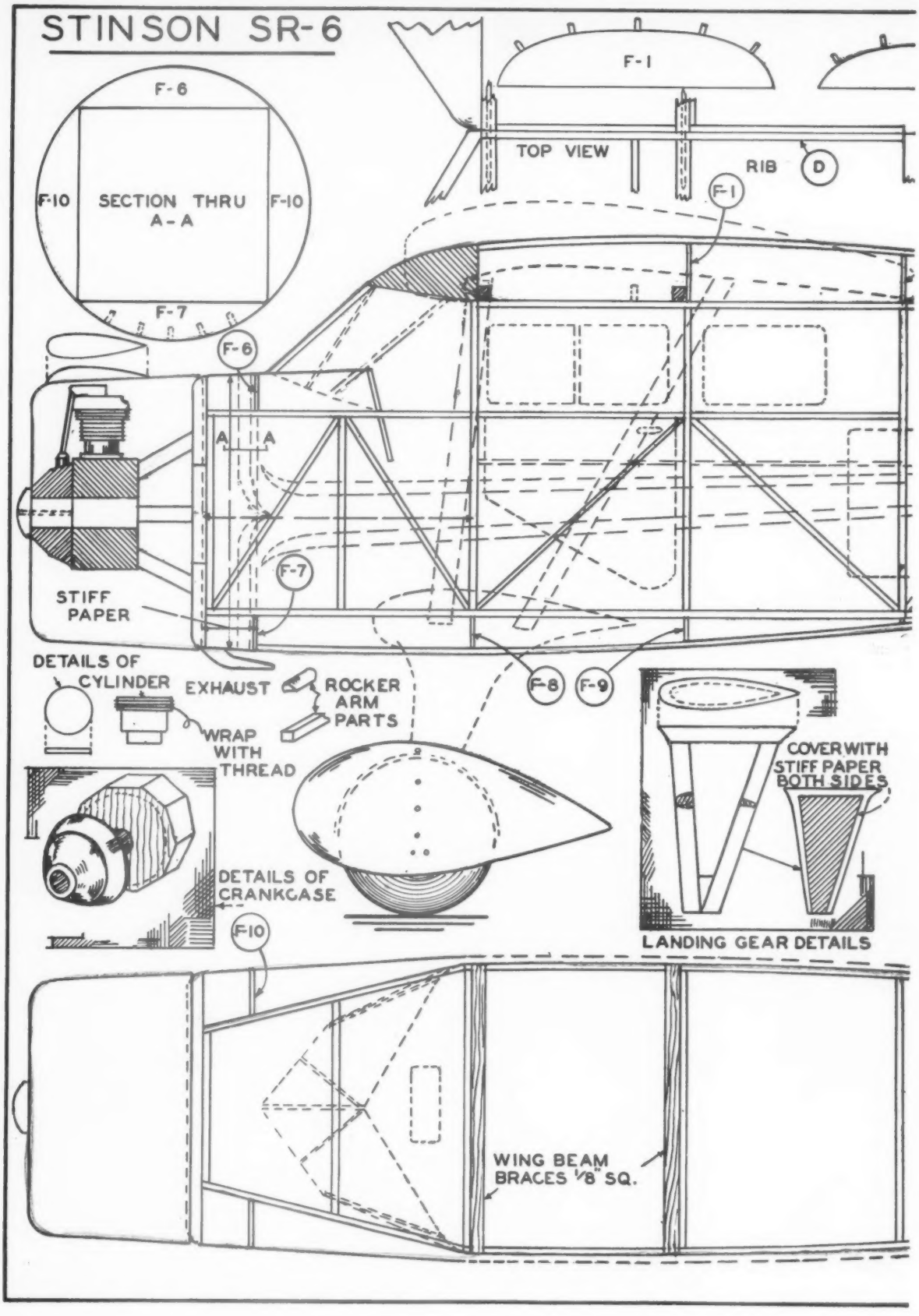
CONSTRUCTION OF LANDING GEAR

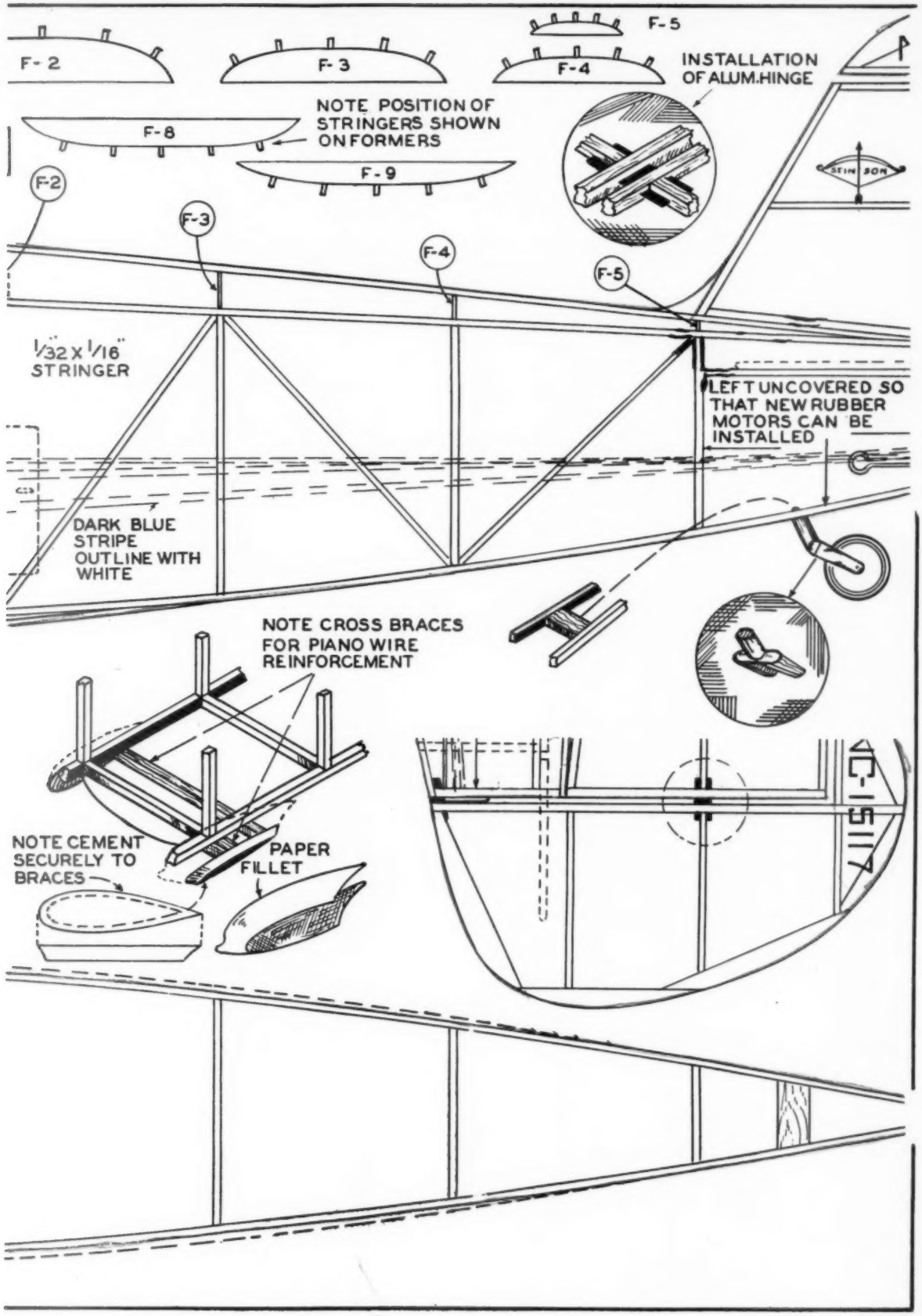
After the struts have been cemented together, cement them to the streamline wheel coverings. The wheel coverings are carved from three pieces of balsa and cemented together. Details on plan clearly show shock absorbing arrangement. The model can be built with or without shock absorber; however, we recommend the shock absorber, because it prevents damage to undercarriage when landing.

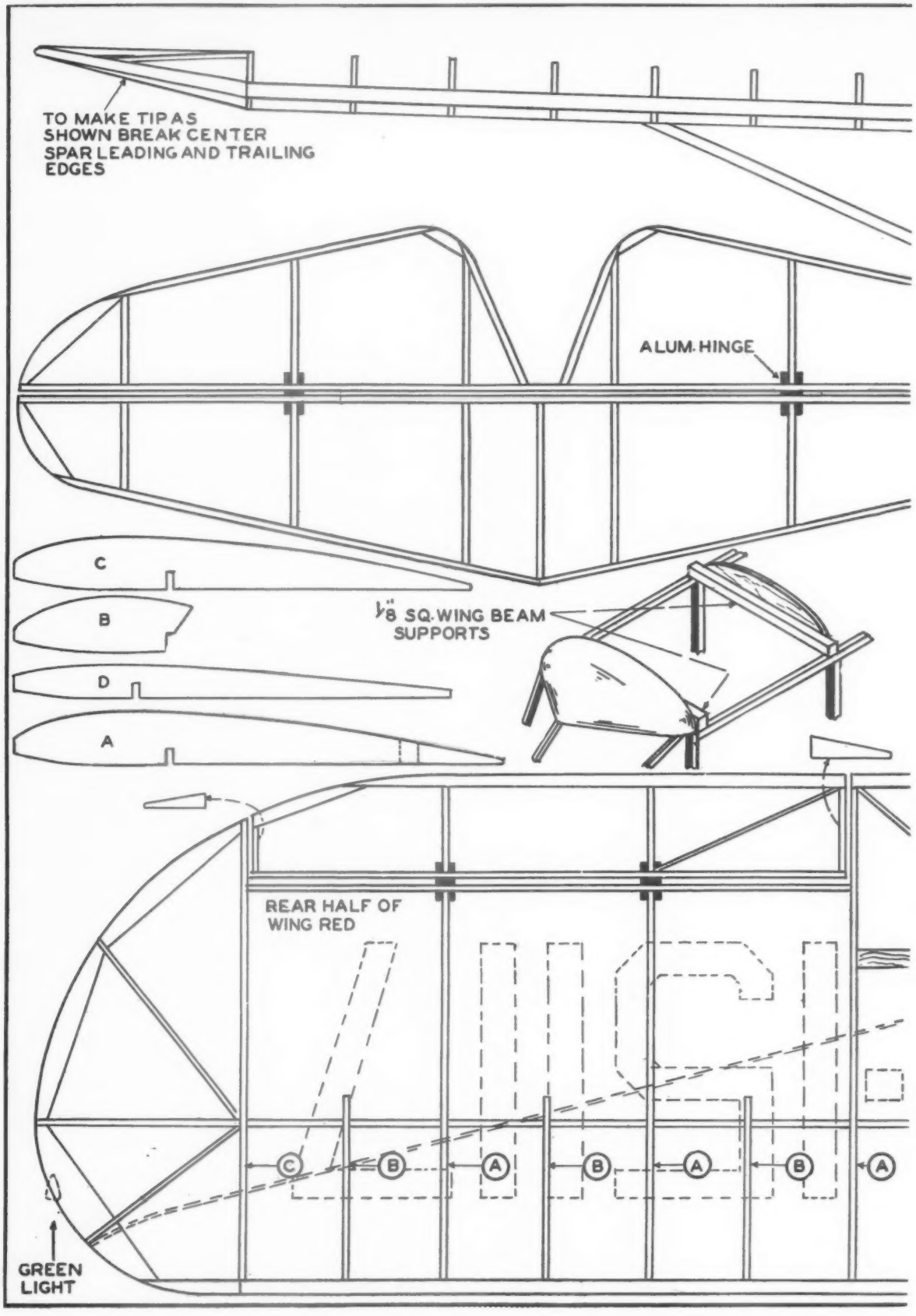
COVERING THE MODEL

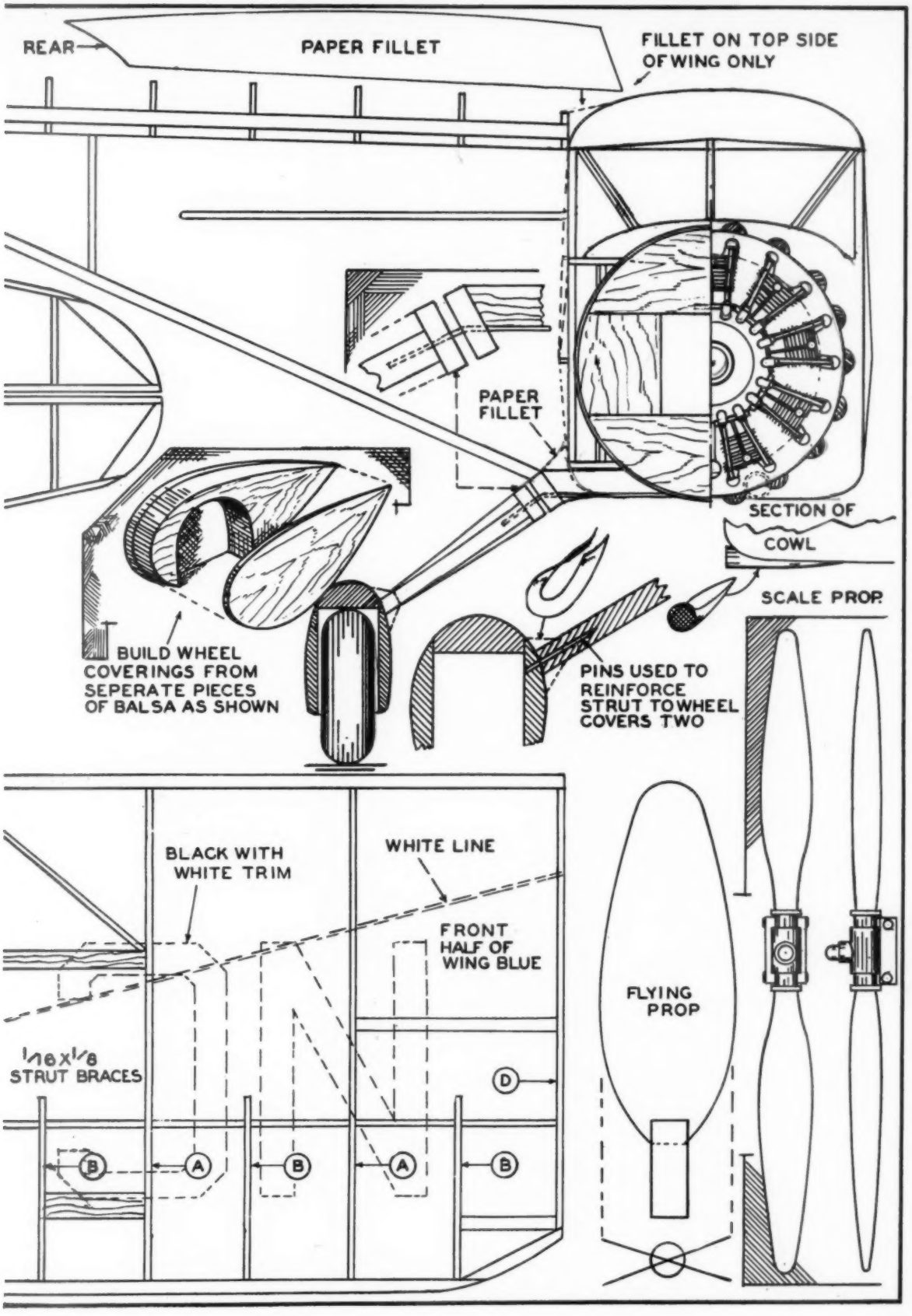
Apply tissue to the various framework members, using a light grade model air-

(*Concluded on page 52*)


STINSON SR-6
F-6
F-10
SECTION THRU A-A
F-10
F-7
F-1
TOP VIEW
RIB
D
F-1
F-6
A
A
F-7
STIFF PAPER
DETAILS OF CYLINDER
EXHAUST
ROCKER ARM PARTS
WRAP WITH THREAD
F-8
F-9
COVER WITH STIFF PAPER BOTH SIDES
LANDING GEAR DETAILS
DETAILS OF CRANKCASE
F-10
WING BEAM BRACES 1/8" SQ.


F-2
F-3
F-4
F-5
INSTALLATION OF ALUM. HINGE
NOTE POSITION OF STRINGERS SHOWN ON FORMERS
F-8
F-9
STIN BOM
F-2
F-3
F-4
F-5
1/32 X 1/16" STRINGER
LEFT UNCOVERED SO THAT NEW RUBBER MOTORS CAN BE INSTALLED
DARK BLUE STRIPE OUTLINE WITH WHITE
NOTE CROSS BRACES FOR PIANO WIRE REINFORCEMENT
NOTE CEMENT SECURELY TO BRACES
PAPER FILLET
CL-15A


TO MAKE TIP AS SHOWN BREAK CENTER SPAR LEADING AND TRAILING EDGES
ALUM. HINGE
C
B
D
A
1/8 SQ. WING BEAM SUPPORTS
REAR HALF OF WING RED
C
B
A
B
A
B
A
GREEN LIGHT


REAR
PAPER FILLET
FILLET ON TOP SIDE OF WING ONLY
PAPER FILLET
SECTION OF COWL
SCALE PROP
BUILD WHEEL COVERINGS FROM SEPERATE PIECES OF BALSA AS SHOWN
PINS USED TO REINFORCE STRUT TO WHEEL COVERS TWO
BLACK WITH WHITE TRIM
WHITE LINE
FRONT HALF OF WING BLUE
1/16 X 1/8 STRUT BRACES
FLYING PROP
A
B
D

Yes—Our Feminine Readers Build Models?

WE have a most interesting letter from Miss Barbara D. Maschin, 41 West Silver St., Westfield, Mass., in which she tells of her extended experience in model building. She started about four years ago and it has now become an established hobby with her.

And she is not content with simply building models. She has entered many model contests and has made notable winnings. She won the New England Outdoor Stick Type Championship, May, 1934; Western Massachusetts Outdoor Championship, August, 1934; Western Massachusetts Outdoor Stick Type Championship, August, 1934; New England Outdoor Stick Championship, May, 1935.

This is most interesting, and we trust that it will be an inspiration for our other feminine model builders to tell us of their experiences. Miss Maschin promises to write of certain interesting incidents that have occurred from time to time during her model career and we will await her story with interest. And, by the way, we must not forget her brother Harold who first aroused her interest in the subject.

* * *

Then, right after the arrival of Miss Maschin's letter came a letter from Mrs. Helena Price, 130 N. Warren St., Trenton, N. J., who, among other things, owns up to being nearly thirty years of age. This last revelation is truly remarkable and entitles her to a hundred additional credit marks.

Mrs. Price says that she has been a model builder for over a year and that she is building commercial types exclusively. At the state fair, last year, she was the only feminine entrant out of more than a hundred model exhibitors and the only one to exhibit more than two models. She exhibited models of the Kinner Cabin job, a Fairchild 22, etc. The Fairchild is a 26-inch replica, true to the smallest detail, even including some personal alterations of the ship owned by Gil Rob Wilson, State Director of Aviation.

Fellows, meet Miss Barbara Maschin, one of our feminine model builders and prize winners.

Mrs. Price who, by the way, is a student aeronautical engineer, wishes to contact other "femmes" with the same hobby. We trust that the other girls, ladies and women will correspond with her on this point of mutual interest. She wishes to know whether she is too old for this most entrancing of sports. And we will answer—ABSOLUTELY NOT!

And now we get down in the pile of letters to the report made by Miss Nina Jensen, 739 Church Avenue, Brooklyn, N. Y., who confesses a fondness for airplane model making. She makes both flying and non-flying types and, all in all, has made about twenty-five of the little ships.

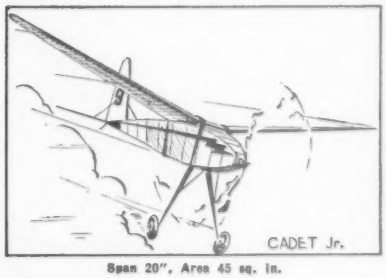
Miss Jensen says that there are about fifty girl model builders in Brooklyn and she has seen their products. I only wish that Miss Jensen would round them up and have them send in their experiences so that we could start another column.

Balsa in Tree Form

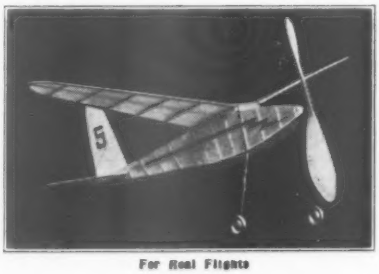
MANY of our modelists will be interested in seeing a real balsa tree. The balsa tree below is growing on an American experimetal farm.

A Balsa tree in the foreground.

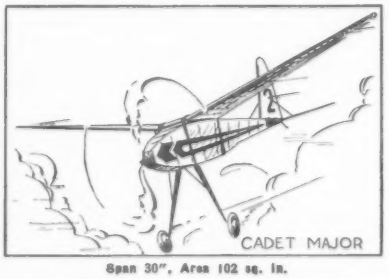
A REVELATION IN MODEL AIRPLANES



Span 20", Area 45 sq. in.



For Real Flights



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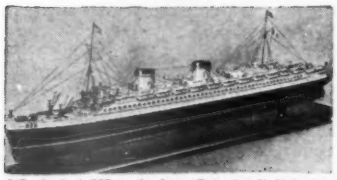

28"—Scale 1/32" to the foot. Patented Hull Design. Shaped hull and over 100 metal fittings. 24 cast metal lifeboats; 24 cast stairways; 2 cast anchors; 4 metal propellers; 6 cast bits; 48 metal davits. The Rex comes in beautiful high luster original colors of black, orange, white, red and green; and the kit also contains turned wood parts, printed wood, cement, wood filler, sandpaper, etc., postpaid..... **$6.00**

West of Denver 50c extra.

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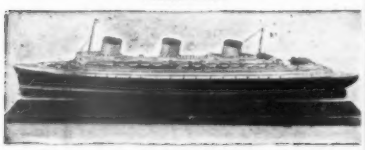

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Flies 100 feet to 300 feet

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It comes to you ready to fly in ten seconds. All you do is slip in the tail and wing, wind the propeller, and then . . . some REAL THRILLS!!

You can make it do lots of tricks, too. Fly straightaway, circle, and then make a perfect landing.

And it's durable—even though it's feather light. The fuselage and propeller are molded of strong material that will stand a lot of forced landings.

Mickey's airplane is a beauty, too—colored red, black and yellow.

Wingspan ....16½ inches
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Price postpaid **75c**

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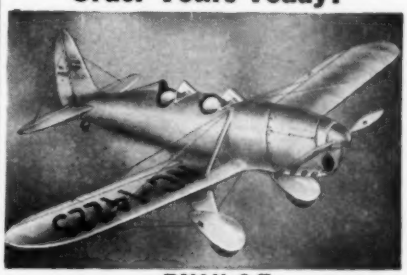

RYAN S T

Wingspan 22½", length 16½", weight 2½ oz., scale ¾". New fast Ryan has dual control system which operates in either cockpit; adjustable wing flaps; plans for making an actual working engine—4 cylinders with movable pistons, carburetor and spark plugs.
Complete kit **$1.50**

BOEING P-26A

Wingspan 21¼", length 16", weight 2½ oz. Exact ¾" scale. This flying model is an exact replica of the famous fighter—one that is identical in all but size with its noteworthy big brother. Beautifully colored in olive drab and yellow. All Super-Detail parts included.
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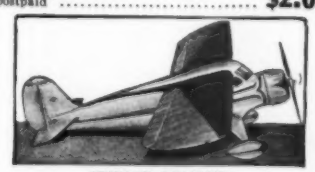

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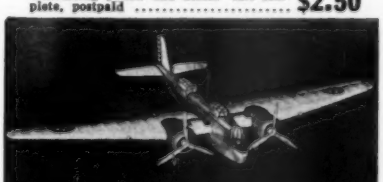
Wingspan 32 5/16", length 21¼", weight 3½ oz., exact ¾" scale. Adjustable speed arresters built into the wings, movable cabin doors, complete interior with four seats and control column, and all the other Super-Detail features. Colored in bright contrasting yellow and black. Kit complete, postpaid **$2.50**



MARTIN BOMBER

Wingspan 33", length 22½", weight 4½ oz. Exact scale. Retractable landing gear, rotating gun turret, movable machine guns, special streamline cowlings, two types of 3 bladed propellers—one for flying and one for exhibition with removable motor sticks for flying; rudder and elevator balanced surfaces; new type fresse ailerons.
Kit complete, postpaid..... **$3.50**

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XUM

Book Review

(*Continued from page 43*)

SAMUEL PIERPONT LANGLEY, by C. G. Abbot, Secy. Smithsonian Institution. Volume 92, No. 8, Smithsonian Miscellaneous Collection, Publication 3281. 57 pages, paper binding. Date: Aug. 22, 1934. Published by the Smithsonian Institution, Washington, D. C.

THIS is a most intimate biography of an outstanding pioneer in aviation and one of America's most versatile men of science. While the greater part of the volume is concerned with Langley's astronomical research, yet there is a section of very great interest that describes Langley's "Aerodrome" and its engine, facts that have seldom been made public.

A great deal of attention is paid to the construction of the first radial engine, a water-cooled type which developed 52 h.p. and weighed one kilogram (2.2 pounds) per horsepower, empty and without accessories. Complete and with water and battery, the total weight was less than 5 pounds per horsepower. As this was 'way back in 1899, and suitable materials were lacking, the engine may be considered as a wonderful achievement.

* * *

TECHNICAL AERODYNAMICS, by Karl D. Wood, Assistant Professor of Mechanics of Engineering, Cornell University. 330 pages, cloth bound. Date: Sept., 1935, 1st Edition. Published by McGraw-Hill Book Company, New York City, N. Y. Price: $3.50.

A PRACTICAL book upon airplane performance and stability calculations, suitable for technical students, engineers and draftsmen. The author presents technical data on the computations of stability, performance and graphical solutions for downwash, etc. Much attention is also paid to the properties of airfoils and parasitic drag, the data being taken from recent airplanes.

It is very suitable for school use since each chapter or section carries a list of problems to be worked out. Throughout the book, are examples that illustrate the principles involved in certain operations, all worked out in numerical form. Computations for seaplane and flying boat hulls are given a considerable amount of attention so that practically every subject required by a designer is covered in considerable detail.

END.

$1.00 "G" TOMMY GUN

Completely finished three-quarter size toy gun that is absolutely harmless, yet it draws the attention of everyone, both large and small, by the snappy reports when the trigger is pulled. This realistic toy will please any boy regardless of size, even the fathers will have to try it out and get a real kick. GUN MODEL CO., Dept. S, 2908 N. Nordica Ave., Chicago, Ill.

Model Dept.

(*Continued from page 45*)

plane dope to fasten it to the outer edges. Stretch tissue as tightly as possible to remove all wrinkles. When edges have dried, apply coat of water to tissue. When all water has dried completely, tissue will become taut. May we suggest that you pin wings, elevator and such to flat surface. This prevents warping.

After the various parts have been covered, wing panels can be cemented into position. The wing struts are next cemented into position. A small paper fillet is cemented between top of wing and fuselage. See plan for pattern. All doors, etc., can be drawn in with a draftsman's ruling pen and black ink.

TESTING AND FLYING

Two types of propellers are used on this model. One, which has a wide blade, is made of fiber. This type of blade causes the motor to turn at less R. P. M. and greater flights result. By twisting the blades, the pitch can easily be adjusted. The balsa scale propeller is used for exhibition purposes only. Six strands of ⅛ flat rubber are sufficient to fly the model.

With the rubber motor and flying propeller in place, gently launch your model over tall grass. By this method, you can see if your model is properly balanced. If model glides a short distance, and nose rises abruptly, it will be necessary to add weight to bottom of nose block. If model dives, add weight to tail.

After the model is balanced to glide on an even angle, you are ready to test your model under power. In making the test flight, the principal thing to avoid is damage to your model. Gliding and flying it over tall weeds is the safest, because the weeds or tall grass break the fall gently in case that the model should stall or dive.

A few trial flights will acquaint you with the ship, and all other adjustments can be made through the adjustable control surfaces.

END.

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Army's new streamlined fighter. Flies far and fast. Contains finished balsa cowl and other machined parts. An excellent model . . . one that any builder will be proud of. 50c value.

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Airy Chat

(*Continued from* page 10)

tilizer. And you all know how every scrap taken from a hog is utilized by the packing houses.

But the last bit of conservation or utilization is the application of the bothersome radio static to useful service. Summer static used to drive the radio broadcast listeners nearly mad, but now the roar and crackle of static is being used for the purpose of locating severe storms. And this is something!

* * *

ONE branch of an engineering industry usually obscures many of the equally or more important branches, at least from a publicity standpoint. One branch hogs the limelight while the others work in obscurity. And this is the case both in airplane and automobile construction.

Just as one example of this sort of thing, the engine designer is greeted with glad acclaim as being responsible for the great success of an engine, while in fact there are many other men equally deserving of credit. If it were not for the modern steels and other metals developed by the metallurgist, the engine would be a flop. If it were not for the great accuracy in manufacture made possible by the machine-tool builders, volume production would be impossible.

Without the proper materials and suitable shop equipment for building the engine, it would not make much difference whether the engine was ever designed, for it would be impossible to build it.

Again, in respect to the personnel, hardly anyone on the outside of the plant hears of the production engineer whose purpose, at least in very many cases, is to put a soft pedal on the brainstorms originating in the design department. And then we get to the shop foremen and the final-test who contribute their bit to the development. Many men contribute to the success of a machine beside the designer—and the inventor. This is not written with an idea of belittling the efforts of designers but to give credit, also, to other deserving men.

* * *

THAT reminds me of the fact that I would like to get some stories from the final-test department. They would be interesting and instructive stories because it is the final test that locates and makes suggestions for remedying troubles. We have had several stories on the final flying tests of complete airplanes, but we would like to hear from the modest engine men who are hiding their light under a bushel.

* * *

FROM time to time, we receive letters from our readers asking us how they can get into aviation without money. Such letters generally start, "I am a young man intensely interested in aviation but have no money for taking a course. Can I exchange my services for lessons in flying?"

This is a tough question to answer. If we answer "no," then we are in the wrong because a few men have done it. If we answer "yes," then this answer will necessarily be followed by another question, "how," and this puts us on the spot. We do not believe that more than one percent. of the men now in aviation ever earned their way through by exchanging their services for lessons. The remaining 99 percent. paid in currency.

As the law now stands, it would take a very long time and much work to serve out an apprenticeship. There are many subjects that cannot be easily learned outside of a class-room, making it highly advisable to attend school. It is hard to get around this fact.

Just as a suggestion, which probably will be ignored by the prospective student, we advise that he earn his tuition at some ordinary everyday job and then pay this money to a good school rather than to attempt earning it in aviation. You will be money and time ahead if you follow this course. A few more months working in the grocery store, or in the garage, to get the tuition money is a shorter and less expensive method than to attempt serving time as an apprentice around an airport.

* * *

THEN, there are those who wish to get into the U. S. Army Air Corps,

(*Concluded on page* 56)

Announcing

A NEW IDEA IN MODEL AIRPLANES

1936 MONOCOUPE MODEL 90-A

Science-craft MODEL AIRPLANES

50 Inch Wingspan
Length 32 inches
Weight 10 ounces
Colors: White, Green and Silver

Here's something entirely different from anything you've seen before. Something that will amaze you, something that will revolutionize the model airplane industry. In the past SCIENTIFIC has always offered you the latest airplanes with the newest features. Now again SCIENTIFIC steps forward and introduces new features on the latest 1936 Monocoupe Model. You must build this model to appreciate it. Nothing like it has ever been offered before.

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GUARANTEED TO FLY 500 FEET

This new SCIENCE-CRAFT kit enables you to turn out a perfect model in double-quick time. Takes the hard work out of model building.

The kit is complete in every detail, including a finished 12" balsa propeller; ribs, bulkheads, fairings, wing tips, etc., printed on balsa; finished balsa wheels; fresh rubber; cement; tissue cement; silver and black dope; colored tissue, etc., and full size plans with all details and necessary instructions. SCIENTIFIC has always given you more for your money—now we give you more than ever before.

Go to your SCIENTIFIC dealer now, or send right away and get this remarkable kit and see how easily and quickly you can build a better model, whose flying ability and realistic appearance will amaze you.

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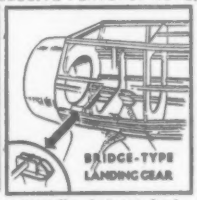
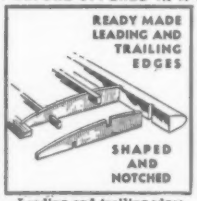


Specially designed landing gear, built right into fuselage where both ends meet, joined solidly, making it one unit.



Leading and trailing edges completely finished. Just apply a drop of glue to ribs and insert in notches of spars.

Aluminum cowling and crankcase cover completely finished. Cowl has streamlines punched out. Crankcase is die-cut to fit around cylinders.

NOTICE: All new features on this model are fully covered by Patents Applied For.

SCIENTIFIC MODEL AIRPLANE CO.
218-220 P1 MARKET STREET, NEWARK, N. J.

BUILD A GLIDER

Send ten cents (coin) for information on easy to build primary and sailplane. Complete detail blueprints for construction only $3.50. Write Speed Westphal, 5512 Drexel Blvd., Chicago, Ill.

NO MATTER WHICH YOU CHOOSE...THERE IS NO FINER XMAS GIFT THAN A SELLEY-TEX Pat. App. for FLYING MODEL CONSTRUCTION SET...*The Modern Method of Model Building!*

TRY THIS REVOLUTIONARY *Practical* METHOD OF SIMPLIFIED BUILDING

and make your holidays HAPPY DAYS!

Look at these models. They vary in appearance and price to satisfy every taste and purse. Each has its special features, but all have this in common—SELLEY-TEX "MOULDED" CONSTRUCTION—the simplest way ever conceived to easily and successfully build and fly true-to-scale models of popular airplanes. Don't try to compare SELLEY-TEX with any All-Balsa Stick Kits because there is nothing on the market to compare them with. SELLEY-TEX is a Patent Applied For process created and owned exclusively by SELLEY and involves a production investment that exceeds the costs of most of the All-Balsa Stick Kit manufacturers combined! If you want the BEST THAT MONEY CAN BUY . . . . BUY SELLEY-TEX. Select the one you like NOW and enjoy it for the holidays!

Each of the SELLEY-TEX Construction Sets contain the necessary individually designed moulded scale parts similar to those shown above.

GREAT NEWS! TWO NEW SELLEY-TEX LUXURY VALUES *at a price everyone can afford!*

10 ADVANTAGES OVER ALL-BALSA STICK KITS MAKE SELLEY-TEX THE BEST "BUY" IN MODEL PLANE KIT HISTORY!

- **MOULDED CONSTRUCTION.** First real advancement in practical building.
- **EXCLUSIVE FABRIC.** Specially close woven and processed by secret formula.
- **EASIER-TO-BUILD.** The moulded parts make it simple as ABC.
- **MORE PRACTICAL.** Selley is discontinuing All Balsa Stick type entirely.
- **MORE AUTHENTICALLY DESIGNED.** Minute details are moulded into model.
- **MORE DURABLE.** The moulded shell is stronger and lighter.
- **BETTER FLYERS.** The moulded fuselage eliminates weight behind center of gravity.
- **POSITIVE MEANS OF BALANCING.** Simple ring device correctly balances plane.
- **FINISHED PROPELLER.** Maximum of thrust and minimum amount of rubber.
- **MONEY BACK GUARANTEE.**

20" WING SPAN

LOCKHEED ORION

1.00 Postage 20c

They contain every feature of our higher priced models except the size.

Now they're here just in time for the holidays! THE NEW 1936 SELLEY-TEX LOW-PRICE CONSTRUCTION SETS! Here, at last, is the MOST AMAZING GIFT BARGAIN ever offered in kit form!

1.25 Postage 25c

SEE COUPON Below ACT Today!

18" WING SPAN

CURTISS OSPREY

EVERY SELLEY-TEX model is packed securely in an attractive red, yellow and black box that makes a beautiful gift package. Give yourself a gift.

SELLEY-TEX

* "I never made such a good looking model or got better flying performance with any balsa stick kit as I have with your 'Goshawk'."

4.00 25c Postage

GOSHAWK

A powerfully attractive flying scale replica of the speedy Navy fighter and accurate to the minutest detail.

* "You are about ten years in advance of all other companies and have beaten a path for the rest to follow."

**Letters on file in our office*

3.00 25c Postage

FAIRCHILD 22

A magnificent example of practical model construction, embracing durability of structure and ease of performance.

* "I took a chance with your 'Boeing F4B4' and am now the proud owner of a self made plane that actually flew."

3.50 25c Postage

BOEING F4B4

A dynamic reproduction of the popular Navy pursuit plane, developed for stamina and designed for speed.

* "I built your 'Waco C Cabin' and want to say that your moulded method is all that you claim it to be."

WACO C Cabin

3.50 25c Postage

A masterpiece of authentic model design, incorporating every scientific feature to insure maximum flying performance.

WACO D Military

4.00 25c Postage

* "The 'Waco D Military' I made certainly gave me a 'rep' with the model builders in my club."

A wealth of military detail characterizes this formidable prototype of the latest Army innovation, and what a flyer!

All other SELLEY-TEX moulded parts as listed are equally easy to build.

Simple as A B C

A—Fit together and cement the two moulded parts of the fuselage.

B—Cut away the border of excess fabric.

C—The result is a perfectly shaped fuselage in the form of a hollow shell, very strong and indestructible.

* "I received the 'Ryan Sportster' and found that your simple method is the most practical way of building a model I ever tried."

3.00 25c Postage

RYAN Sportster

An exceptionally realistic miniature, embodying every modern principle of light commercial planes to assure long distance flying.

PARTS AND ACCESSORIES

Every model is packed in a beautiful, sturdy box with finished scale flying, adjustable pitch metal prop, finished propeller shaft and rear hook, scaled wheels, with brass bushings, ribs printed out accurately on white sheet balsa, many special turned wood parts, finest grade of balsa wood, sticks, tail wheel and fork fittings, control horns and wire, pure para rubber, special bamboo paper, authentic markings, colored insignia, best quality cement, colored dopes, full-size easy-to-understand plan, complete with all picture details. All the tools necessary to build model:

CLAMPS—RAZOR BLADE, BRUSH, SANDPAPER

$1.25 KITS HAVE NO TOOLS

ALL 24-INCH WING SPAN

DEALERS! Cash in on the holiday demand. Write for discounts, propaganda, etc.

A brand new supply catalogue picturing and listing the most popular plane accessories is yours for the asking. Send 3c for postage.

FREE! Write for our beautiful, two-colored broadside illustrating in detail the new line of incomparable SELLEY-TEX Construction sets. Send 3c stamp for postage.

Ask your leading Dept. store or local dealer first. Use coupon if you can't get SELLEY-TEX. Please mention your dealer's name and address.

Please send me the SELLEY-TEX model kits I have checked. I am enclosing $.... (check or money order.) (Each plane 25c postage. West of Denver 35c postage.)

Lockheed Orion	1.00 ☐	Curtiss Osprey	1.25 ☐
New Ryan Sport.	3.00 ☐	Fairchild 22.	3.00 ☐
Waco C Cabin	3.50 ☐	Boeing F4B4	3.50 ☐
Waco D Military	4.00 ☐	Goshawk	4.00 ☐

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★ ARMY ★ INSIGNIA

—while they last

We have a limited number of reprints of the complete set of 60 Army Air Corps Insignia exactly as published in previous 3 issues of POPULAR AVIATION. Twenty insignia to a sheet, in full and exact colors, with the address and war history of each squadron shown.

The latest and authentic insignia gathered from official sources. Just the thing for collectors, model builders, etc.

While they last, 60 insignia, 50c postpaid. Add 10c extra if you wish to receive a reprint of the 20 insignia as published on the back cover of this issue.

POPULAR AVIATION
608 S. Dearborn St. Chicago

FULL SIZE THOMPSON SUB MACHINE GUN

$3.00

Why are you missing the thrills that so many Model Builders are getting out of this latest hobby? Just think of it, an actual size construction kit for building a full size model of the friend of Law and Order, for only $3.00. Perhaps you cannot believe your eyes, but it is true, so why not take advantage of this opportunity at once.

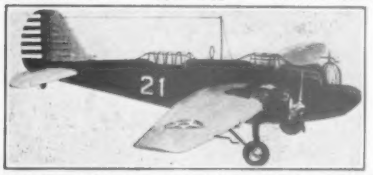
Full Size THOMPSON SUB MACHINE GUN model, completely finished, postpaid to you for only..$4.75
Full Size Colt Cal. 45 auto. pistol kit..... 1.00
Full Size Colt Cal. 45 auto. pistol completed model 2.50
Postpaid in U. S. A. No stamps, please. Checks 15c extra.

GUN MODEL CO., Dept. K, 2908 N. Nordica Ave., Chicago, Ill.

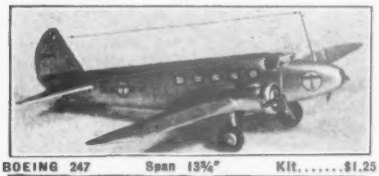
SOLID SCALE MODELS

Actual Photographs

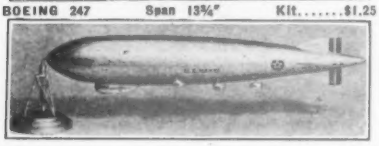
SIKORSKY S-42 Span 17¾" Kit.....$1.75



MARTIN BOMBER Span 17¾" Kit.....$2.00



BOEING 247 Span 13¾" Kit.....$1.25



LOS ANGELES Length 12½" Kit.....$1.25

Each Kit contains everything required to make a perfect and complete (Balsa) Model. Send 3c stamp for illustrated folder. Kits are sent prepaid and insured. West of Denver, Colo., 25c extra. Canadian prices 40% higher. Remit cash by Money Order. No stamps. No C.O.D's.

D. E. L. AERO MODEL WORKS, Dept. B
1018 N. Front St. Philadelphia, Pa.

Airy Chat

(*Continued from page* 54)

and ask us how to get in. To these correspondents we wish to say, at large, that the best way to get into the Air Corps is to enter and graduate from West Point Military Academy. To get into West Point, you must first get an appointment from your congressman and then pass a stiff physical and mental examination.

To sum the matter up, the U. S. Army Air Corps requires flying officers rather than plain pilots, hence the preference always goes to the cadets graduating from West Point instead of to civilians. A military pilot must be more than a simple pilot, he must be thoroughly conversant with military subjects in addition to a knowledge of flying. But the time spent at West Point is well spent. We regard it as one of the greatest universities in the world.

* * *

MANY of our younger readers seem to believe that the main purpose of an airplane factory is to hand out free blue-prints and photographs of the planes that they are building. And, just because the airplane factory does not always see matters in this light, our younger readers wax furious and loudly denounce the manufacturers.

To their credit, we will say that the majority of airplane builders have been very generous and open minded in this respect in the past. Down in their hearts, they have a certain sympathy and understanding for the enthusiastic youngsters and have gone a long way to help them, but of course, there is a limit to which this can be carried out.

The blue-prints and photographs are expensive, it is a lot of bother to mail them and answer fool questions and, besides, they are not in the correspondence school business. One large airplane company, specializing in military planes, once kept two stenographers and a boy exclusively to serving their young friends, but they finally gave it up as a hopeless job.

So, boys, when you fail to receive that roll of detailed blue-prints that you have asked for on a postal card, please don't wail in anguish and write us indignant letters. They cannot be expected to interrupt their work and spend several hundred dollars every month on this sort of project.

However, we think that we have a partial solution for this difficulty that will help both the boys and manufacturers. We are at least going to give it a tryout in the future and, if it works —fine. This scheme will cost the manufacturers only one set of blue-prints and the boys only a few pennies. And we'll be the goat. Howzzatt?

* * *

GOOD news to our readers. POPULAR AVIATION started the year 1936 off with a bang. There is an extra eight pages in this issue because of the increasing demand for the magazine at the news-stands. This, in turn, made it necessary to increase our news-stand distribution so that there are improvements all the way 'round.

Several months ago, we were compelled to increase our press-run from 78,000 to 88,000 copies. The demand still increased, so that we are now running 98,000 copies press-run on the January issue, or 20,000 more copies than we were printing one year ago. The increase in one year is therefore 25.6 per cent.

For all this progress we are indebted to our readers who have always maintained such friendly and even chummy relations with the publishers. It has been a steady build-up by virtue of the friendliness and interest of all you fellows who have perused each issue faithfully from the punctuation marks to the details on the front cover—and we thank you all for your faithfulness to old P. A.

* * *

AND so ends the first Chat of 1936, a year that I sincerely hope will extend prosperity and happiness to all of our readers. Happy New Year to you all.

J. B. R.

NATIONAL KITS "Convey a Merry Christmas!"

Curtiss Army Hawk Pursuit Plane. Excellent flyer. 24" wingspan. Complete $2.00, plus 25c postage.

NATIONAL Super-Detailed Quality Kits will be appreciated by every model builder.
A National Flight Tested Model is a gift you can well be proud of. Just look over the beautiful models pictured on this page and you'll agree that they're exceptional either for giving or receiving. There's a Kit for every purse and purpose—solid or flying scale models at prices from 25c to $5.00—they're all ready, waiting to be sent to you the same day your order arrives, assuring you prompt delivery in time for Christmas.
National's new kits are precision scaled to ¼", ½", ¾" and 1" fully detailed. Order National Christmas Gift Kits today, to assure a very Merry Christmas.

½" **Solid Scale Boeing P-26-A** Complete in every detail 50c plus 10c postage. This model with metal prop, cowl and finished celluloid motor, **$1.00** plus 15c postage.

AKRON FIGHTER. a perfect 12" model of the ship carried in the Dirigible "Akron." 50c plus 10c p.p.

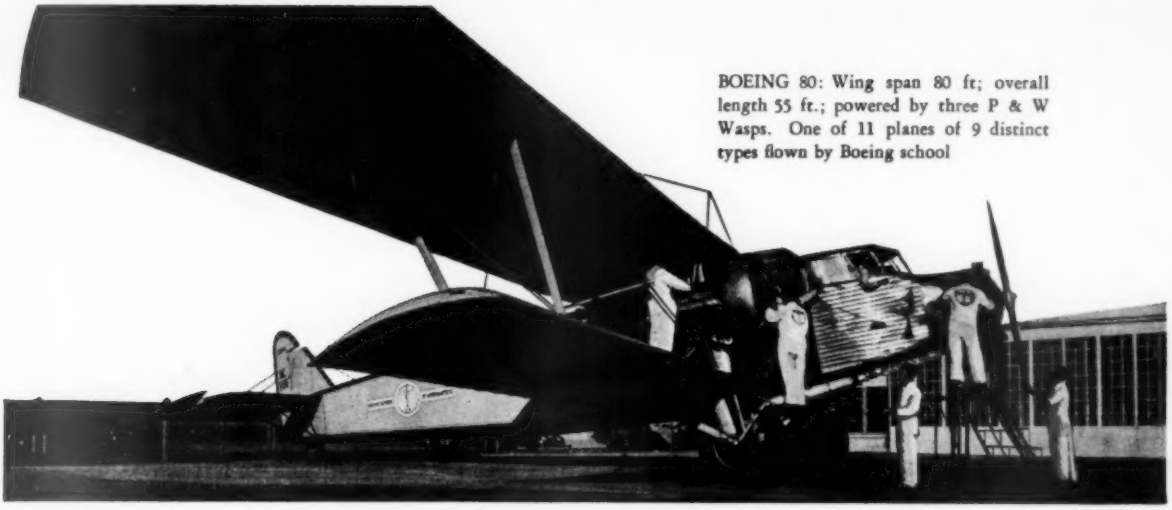
SPAD. Eddie Rickenbacker's wartime plane. 12" wing span 35c plus 10c p.p.

BELLANCA. a perfect model of this famous plane. 12" span. 50c plus 10c p.p.

Send 5c (to cover mailing) for National's New Catalog and Bulletin.
A guide to every model builder. Contains many gift suggestions.

Other National Flight-Tested Models 25c to $5

NATIONAL MODEL AIRPLANE & SUPPLY CO., 23 Ave. E, (Dept. PA4) New Rochelle, N. Y.



BOEING 80: Wing span 80 ft; overall length 55 ft.; powered by three P & W Wasps. One of 11 planes of 9 distinct types flown by Boeing school

Largest Training Transport in U. S. Added to Boeing School Fleet

ANY graduate will tell you this: you fly *bigger* ships at Boeing School.

Even the primary training planes are around 700 pounds heavier, and powered by from 40 to 70 more "horses" than those used at most other schools.

And advanced flight training is given in transport-type ships of up to 7¾ tons and 1350 horse-power.

There is a definite reason for this.

The Boeing School of Aeronautics, as a division of United Air Lines, is in the business of training men for places in the air industry. Experience has proven that men mainly taught in light planes haven't the background needed to pilot commercial transport planes with a gross weight of from 9,000 to 18,000 pounds.

All instruction at Boeing School—flight, shop and laboratory—is similarly related to actual air industry operations as practiced by the most experienced air transport company in the world.

Standards are higher, courses more comprehensive and thorough at Boeing. For example:

The most complete flight, ground and executive training any air school can offer, the Boeing Airline Pilot and Operations course – tuition $5,800 – 4015 hours of instruction . . . design and lubrication . . . metallurgy . . . meteorography . . . power plants . . . communications . . . airline operations, from organization and personnel to revenue and traffic . . . instrument and landing beam instruction, and dual and solo flying in 11 ships of 9 different types.

Write today for full information about the Boeing School's complete range of courses. From the 9 months Airline Technician Course (tuition $600) — and Private Pilot Course ($835)—to the Boeing Airline Pilot and Operations Course of 24 months ($5800), the most thorough flying and ground training any school can offer. Convenient payment plan. Mail coupon today.

PLACEMENT

Boeing makes no promises of finding graduates jobs. It is a fact, nevertheless, that in 1933-34 the number of graduates to find placement equalled 84% of the number graduated in those years. And during the first 9 months of 1935, over 100 positions have been filled.

* * *

BOEING SCHOOL OF AERONAUTICS

DIVISION OF UNITED AIR LINES

BOEING SCHOOL FLIGHT ADVISORY BOARD

WALTER ADDEMS, chief pilot eastern division, United Air Lines. 16 years in aviation. 850,000 miles in the air.

WARREN D. WILLIAMS, chief pilot mid-western division, United Air Lines. 14 years in the industry, with a record of over a million air miles.

HAROLD T. LEWIS, chief pilot western division, United Air Lines. A pioneer of the Coast-to-Coast air mail. 20 years in the industry. A million miles in the air to his credit.

These veterans of line operations lay out flight instruction courses at Boeing School.

NEXT REGULAR ENROLLMENT DECEMBER 30

Boeing School of Aeronautics, Dept. H-1, Airport, Oakland, California

Gentlemen: I am interested in further information about the courses checked below:

- ☐ Boeing Airline Pilot
- ☐ Transport Pilot
- ☐ Limited Comm'l Pilot
- ☐ Private Pilot
- ☐ Amateur Pilot
- ☐ Airline Mechanic
- ☐ Airline Operations
- ☐ Airline Pilot and Operations
- ☐ Airline Technician (Open to Engineering graduates)
- ☐ Special Airline Pilot (For Transport Pilots only)
- ☐ Home Study Courses (For those employed in the industry)

*Name*_____ *Age*_____

*Years in High School*_____ *Years in College*_____

*Address*_____ *Phone*_____

*City*_____ *State*_____

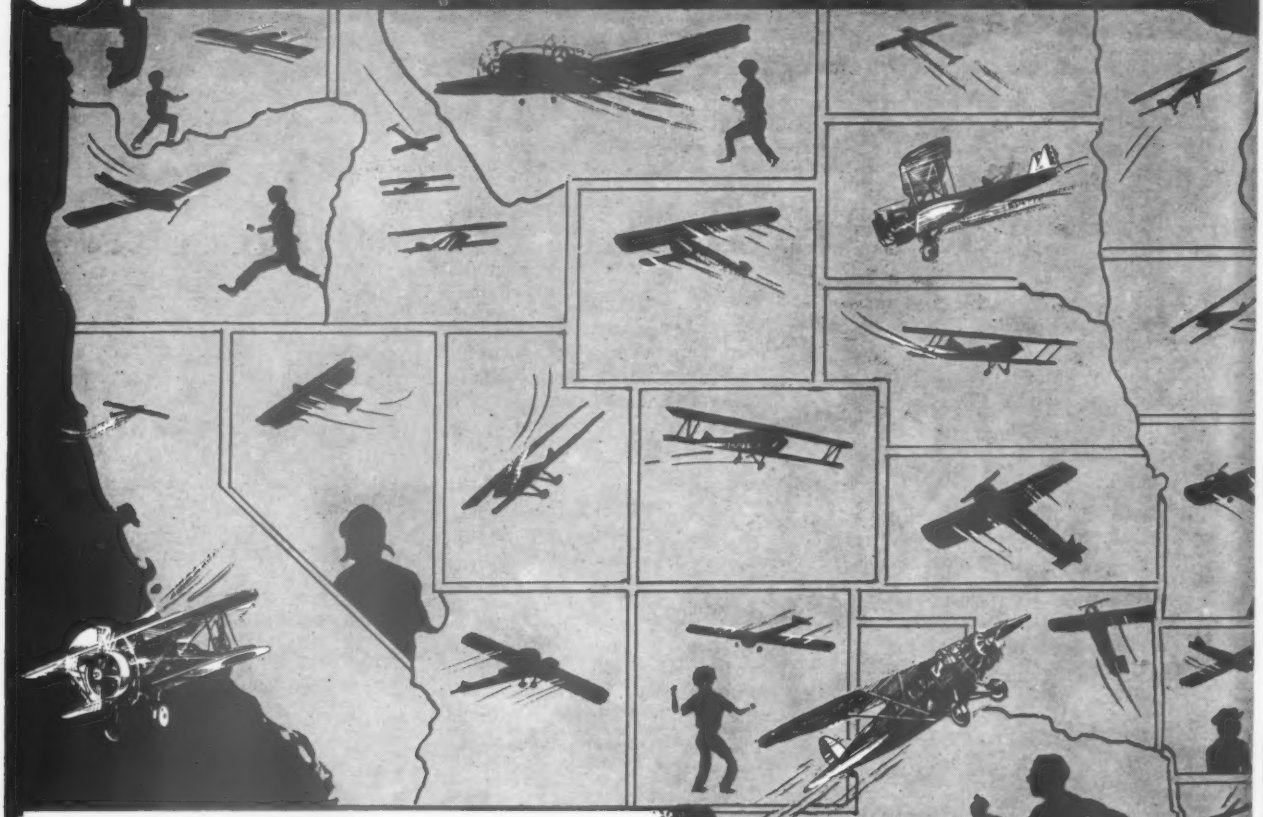
DEPARTMENT OF TECHNOLOGY

THE THRILL OF A LIFE TIME

America Acclaims G·H·Q·5

FROM FLORIDA TO MAINE - FROM MAINE TO CALIFORNIA-IN BIG CITIES

5 FOOT SCALE MODELS 1/3 ACTUALLY OF REAL



5 ft. Monocoupe

Also
5 ft. Stinson Reliant
5 ft. Heath Parasol

NOTE: We have dealers in almost every city. Visit your dealer first for our kits. If you cannot locate a dealer who can supply you, order direct from us. Send money order, check, stamps, or cash. Send only one dollar if you want express delivery, charges collect.

24 HOUR SERVICE ON ALL ORDERS

FREE! Our illustrated catalog of planes ranging from 10c to $1 with each order.

IS YOURS THIS XMAS!

ft. Models *with delirious Joy!*

- SMALL TOWNS - VILLAGES - AND FARMS EVERYBODY IS FLYING OUR

THE SIZE PLANES! **$1 EACH**

PLUS 35c FOR PACKING, POSTAGE AND INSURANCE

IF EXPRESS COLLECT SEND ONLY $1.00

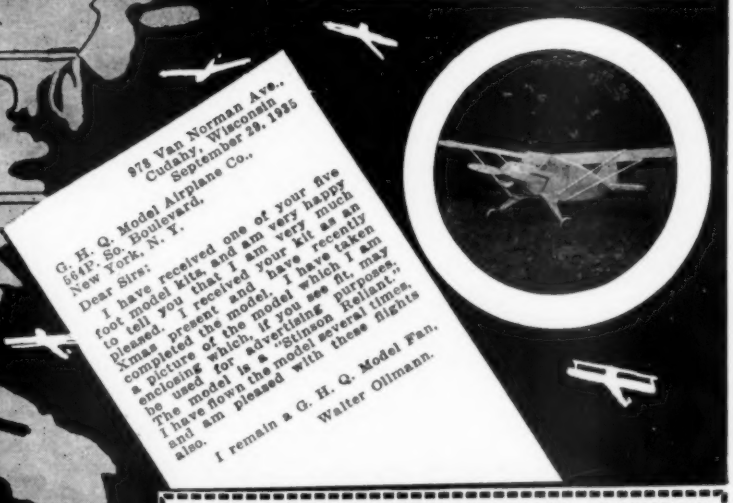
And what a thrill Christmas will be for you if you send away for one of our new Giant Models. Here is the "real" thing every red-blooded man or boy has always wanted.—Just imagine you build planes that are actually 1/3 the size of real passenger carrying planes! Won't this be the happiest Christmas of your life? Thousands of letters from all parts of the country are praising these Giant Models—and if you could only read them—happy, grateful, amazing letters that are delirious with joy speaking of the real flying achievements of these planes. And don't you think we feel proud—proud of this terrific response of the model builders of America? 21,000 of these models have been sold and built (proof of this in our files)—representing 21,000 enthusiastic endorsers of our planes. Everything is in the kit INCLUDING ALL LIQUIDS,—nothing else to buy! Won't you make this the best Christmas you've ever had? Don't delay—get the thrill of a life-time—be the owner of an amazing gigantic model—a strong outdoor flyer—A $10.00 value for only $1. Inspect our kits at any dealer or read for yourself what each kit contains and send your order today.

CONTENTS: Each of these new G.H.Q. Giant 5 ft. Model Planes contain full-size Plans, all ribs, formers and curved parts clearly printed on best grade Balsa. Large bottles Cement and Dope, different colors Japanese Tissue, Special Endurance Rubber, finished Ready-Cut 3" Wheels, Wire, Balsa strips cut to size, Washers, and . . . Movable Controls, shockproof Landing Gear, Scale Details, Lettering, Numbering and Insignias, Flight Log, etc.

G. H. Q. KITS

FLY BETTER
COST LESS
CONTAIN MORE !

ALL HIGH QUALITY
ACCURATE for EXPERTS
EASY for BEGINNERS !



973 Van Norman Ave.,
Cudahy, Wisconsin
September 29, 1935

G. H. Q. Model Airplane Co.,
564P. So. Boulevard,
New York, N. Y.

Dear Sirs:

I have received one of your five foot model kits, and am very happy to tell you that I am very much pleased. I received your kit as an Xmas present and have recently completed the model. I have taken a picture of the model which I am enclosing which, if you see fit, may be used for advertising purposes. The model is a "Stinson Reliant," I have flown the model several times, and am pleased with these flights also.

I remain a G. H. Q. Model Fan,
Walter Olimann.

36" Flying Scale Models **50c** Plus 20c Postage

G. H. Q. Scale Models are the best Kits your money can buy for appearance and flights. Buy one today and you'll buy a whole fleet of them. Get acquainted with G. H. Q. Kits and no others will do.

36" CURTISS A-8 ATTACK 50c; 36" NORTHROP GAMMA "SKY CHIEF" 50c—36" DOUGLAS Y-12 50c. Complete in every detail.

G. H. Q. MODEL AIRPLANE CO.

564 P. Southern Boulevard, New York, N. Y.

G.H.Q. MODEL AIRPLANE CO., 564 P. SOUTHERN BLVD., NEW YORK, N.Y.

Enclosed find $..... Please send the following kits as checked.

12" SOLID KITS
- ☐ Boeing 247D
- ☐ Ryan Racer
- ☐ G.A. Coast Guard Amphibian
- ☐ D.H. Comet
- ☐ Lockheed Orion
- ☐ Sikorsky S-41
- ☐ Douglas Airliner
- ☐ Dewoitine D-33
- ☐ U.S. Army Martin Bomber
- ☐ Monocoupe 145D

12" Kits 15c each postpaid.

24" FLYING KITS
- ☐ Curtiss JN4
- ☐ Bellanca
- ☐ Nieuport
- ☐ Douglas Mailplane
- ☐ Stinson "R"
- ☐ Puss Moth
- ☐ Fokker D-7
- ☐ Fokker D-8
- ☐ Polish Fighter
- ☐ Monocoupe
- ☐ Falcon
- ☐ Aeromarine
- ☐ S. E. 5
- ☐ Sopwith Camel

24" Kits 35c each postpaid.

- ☐ Aeronca
- ☐ Fairchild
- ☐ Army Hawk
- ☐ Curtiss Robin

36" FLYING KITS
- ☐ Douglas Y-16
- ☐ Curtiss A8 Attack
- ☐ Northrop Gamma "Skychief"

5 FT. FLYING KITS
- ☐ Monocoupe
- ☐ Stinson Reliant
- ☐ Heath Parasol

SEND MONEY ORDER, CHECKS, STAMPS OR CASH. Don't Fail to Include Postage for Each Kit With Your Order. One-Day Service.

Name .....
Street .....
City ..... State .....

BUFFALO PUBLIC LIBRARY, DEPARTMENT OF TECHNOLOGY

The World's Planes and Builders

(*Continued from page 30*)

HOLLAND		
The N. V. Nederlandsche Vliegtuigenbabriek (Fokker), Rokin 84, Amsterdam-C.	Fokker F.XII.	3-engine 16-seat cabin monoplane.
	Fokker F.XVIII.	3-engine 14-seat monoplane.
	Fokker F.XX.	3-engine 12-seat monoplane with retractable landing-gear.
	Fokker FXXII.	4-engine commercial monoplane, 22 passengers.
	Fokker FXXXVI.	4-engine commercial monoplane, 32 passengers.
	Fokker D.XIX.	1-seat fighter biplane.
	Fokker C.V-E.	2-seat military general-purpose biplane.
	Fokker C.X.	2-seat fighter or light-bomber.
	Fokker C.X.-W.	Observation seaplane or light bomber.
	Fokker C.VII-W.	Light observation or advanced trainer seaplane.
	Fokker C.VIII-W.	3-seat long-distance observation seaplane.
	Fokker T.IV.	Twin-float, twin-engine observation monoplane.
Koolhoven Vliegtuigen, Waalhaven Aerodrome, Rotterdam.	Koolhoven F.K.40.	4-6-passenger cabin monoplane.
	Koolhoven F.K.43.	4-seat cabin monoplane.
	Koolhoven F.K.45.	1-seat advanced training military biplane.
	Koolhoven F.K.46.	2-seat training biplane.
	Koolhoven F.K.47.	2-seat training biplane.
	Koolhoven F.K.48.	6-passenger cabin monoplane.
	Koolhoven F.K.50.	2-engine commercial monoplane.
H. Pander & Zonen, The Hague.	Pander EF.85 Biplane.	2-seat school or sport biplane.
	Pander EG.100 Biplane.	Revision of the EF.85.
	Pander EG.100 Single-Seat Biplane.	1-seat for long-range flying.
	Pander P.III Monoplane.	2-seat super-sport monoplane.
	Pander "Multi-Pro".	2-seat cabin monoplane.
	Pander "Postjager".	3-engine high-speed mail-carrier.
HONDURAS (None)		
HUNGARY		
Muegyetemi Sportrepulo Egyesulet (Sport-Flying Association of the Technical University), Budapest.	Gerle 12.	2-seat training or sport biplane.
Manfred Weiss Flugzeug Und Motorenfabrik Aktiengesellschaft, V. Maria Valeria Utca 17, Budapest.	W.M. 10.	2-seat light training biplane.
IRELAND (None)		
ITALY		
Colonel G. A. Aldo Guglielmetti, Naples.	A.G. Monoplane.	2-seat low-wing cantilever monoplane.
Cantieri Aeronautic Bergameschi, Ponte San Pietro, Bergamo.	Bergameschi PL.3.	2-seat long-range monoplane.
Societa Italiana Ernesto Breda, Via Bordini 9, Milan.	Breda 19.	Single or 2-seat advanced training biplane.
	Breda 25.	2-seat advanced training biplane.
	Breda 26.	2-seat primary training biplane.
	Breda 27.	1-seat fighter.
	Breda 28.	2-seat acrobatic training biplane.
	Breda 32.	11-passenger commercial monoplane.

(*Concluded on page 62*)

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don't wait till the very last minute. Don't risk disappointment—see your dealer immediately, so he can get what you want if he hasn't it in stock. If he can't give you service—order direct from us. C-D's are the finest kits your money can buy, you know, so get some of both Dwarfs and ¾" scale kits—but ACT QUICK. Tell Mother, Dad, Sister, Wife and friends to SHOP EARLY!—then we'll know you'll have a MERRY CHRISTMAS! Special delivery service on Dwarfs 15c, SF kits 25c.

DEALERS still accepting last minute orders. Make up your list AT ONCE—and get it in the mail so we can give you RUSH service.

Two large beauties (space does not permit illustrating 'em)—SF-35: Boeing 247, and SF-45: Martin Bomber, at $8.50 each. Rush 5c stamp for Illustrated List showing them and 20 others not listed here.

The Great Lakes Sport Trainer
Span 20", length 15⅝". Beautiful flights. Easy to build. Orange and cream. Kit SF-1, $2.65.

Famous Travel Air Mystery Ship
Span 21¾", length 14⅛". Swift flyer. Rich in detail. Red, black scalloping, green trim. Kit SF-2, $2.95

Beautiful Fokker D-7 Fighter
Span 21¼", length 17". Rich in details. Orange, green, white, black details. Kit SF-15, $2.95.

All SF ¾" Kits Contain:

Pilot and propeller blocks and coloring. Black for all details. Thread for bracewires. Finest grade balsa—clearly printed out. All necessary strip wood. Sufficient dope, cement and tissue cement. Material for both flying and scale propellers. Photos and full size copyrighted drawings. Authentic rib and stringer material. All necessary insignia, tape for color striping, etc., etc.

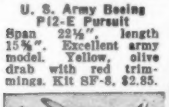
Priced 98c to $3.75; Two at $8.50

U. S. Army Boeing P12-E Pursuit
Span 23½", length 15⅝". Excellent army model. Yellow, olive drab with red trimmings. Kit SF-8, $2.85.

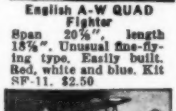
English A-W QUAD Fighter
Span 20⅝", length 15⅞". Unusual fine-flying type. Easily built. Red, white and blue. Kit SF-11, $2.50

Von Richthofen's Fokker Triplane
Span 17⅝", length 14½". Famous war model. Authentic coloring. Red, silver and white. Kit SF-14, $2.50.

U.S. Army Boeing P-26
Span 20⅝", length 17⅜". Very popular. Super-detailed. Yellow and olive drab. Kit SF-23, $2.50.

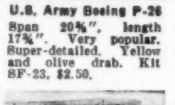


Schneider Winner—Supermarine S6-B
Span 23½", length 21⅝" overall. Many unusual features. Will R.O.W. Silver and blue. Kit SF-19, $2.50.



Hawker Highspeed Fury Fighter
Span 22¼", length 19½". Redesigned. Long fast flights. All silver. Kit SF-20, $2.65.

U. S. Army Hawk P6E Fighter
Span 23⅝", length 16⅝". Most authentic Hawk on the market. Yellow, olive drab, Selfridge Field markings. Kit SF-21, $3.25.



Big Boeing 95 Mailplane
Span 33¼", length 24⅝". Easy for beginners. Good duration flights. Blue and silver. Kit SF-32, $2.50.

'32 Air Race Winner—Geo-Bee Supersportster
Span 18⅝", length 13⅝". Fast flights. A beauty in looks. White, red scalloping. Kit SF-27, $2.50.

Photo not yet ready

Popular Monocoupe Sportplane
Span 24", length 15¼". Has won many first prizes in contests. Cream and orange. Kit SF-28, $2.50.

U.S. Navy Boeing F4B3 (or 4)
Span 22½", length 15⅝". Exciting to build—thrilling to fly. Silver, yellow and red. Kit SF-29, $2.85.

Popular Waco C Cabinplane
Span 24⅝", length 19¼". Beautiful model. Good flyer. Silver and red. Kit SF-37, $3.25.

Aeronca C-3 Sportplane
Span 27", length 15¼". Keen flights and very easy for beginners. Red and silver. Kit SF-40, $2.65.

2-place Vought Corsair V-65
Span 26⅝", length 19¾". Super detailed. Beautiful flights. Blue, yellow, red, black, and silver. Kit SF-41, $3.75

'30 Air Race Winner—Laird Solution
Span 15⅞", length 13⅝". A fast flyer. Pretty lines. Gold and black. Kit SF-46, $2.50.

'33 Air Race Winner—Wedell's W-Williams
Span 19¼", length 16¾". Very beautiful in appearance and flights. Red, black and bronze. Kit SF-47, $2.95.

'34 Air Race Winner—Turner's W-Williams
Span 19¼", length 16⅝". Roscoe Turner's plane. Fast flying. Wedell-Williams gold. Kit SF-48, $2.95.

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COMPLETE CATALOG 5c

DWARF KITS

(Kit numbers correspond to SF Kit numbers)

Kit	Price
D-1	65c
D-2	50c
D-8	65c
D-11	45c
D-14	45c
D-15	60c
D-17	50c
D-18	30c
D-19	65c
D-20	45c
D-21	75c
D-23	85c
D-24	85c
D-26	35c
D-27	50c
D-28	45c
D-29	65c
D-32	85c
D-33	30c
D-35	$2.50
D-36	25c
D-37	75c
D-40	60c
D-41	85c
D-42	25c
D-43	85c
D-45	$2.50
D-46	50c
D-47	50c
D-48	50c
D-49	85c

When 6 or more "Dwarfs" are ordered at one time, you save the "10c per Kit" handling charge.

'31 Air Race Winner—Bayle's Geo-Bee
Span 17⅛", length 12" Speedy flights. Beautiful lines. Yellow and black. Kit SF-17, $1.95.

The Swift Howard Racer "Pete"
Span 15", length 13⅛". Excellent flights. Easy to build. All white, black details. Kit SF-18, $1.35.

The World-Renowned Lockheed Vega
Span 30⅜", length 20⅝". Beautiful in looks—and flights. Brilliant red and cream. Kit SF-24, $3.25.

Long Flying Heath Parasol Sport
Span 23½", length 12⅝". Excellent for beginners. Steady flyer. Orange and black. Kit SF-26, 98c.

Comper Swift Lightplane
Span 18", length 13⅝". Redesigned. Excellent flights. Green with black fuselage design. Kit SF-33, $1.25.

Sensational Lincoln Sport
Span 15", length 12⅛". Beginner's model. Interesting flights. Cream, black trim. Kit SF-36, 98c.

4-Wheeled Howard Racer "Ike"
Span 15⅝", length 12⅞". Flies and climbs beautifully. Also data for "Mike." White, black details. Kit SF-42, 98c.

Douglas O-38 Observation
Span 30¼", length 22⅝". Very beautiful, and unusually well detailed. Yellow, olive drab, black details. Kit SF-43, $3.75.

All Dwarf ½" Kits Contain:

practically everything you get in the ¾" Kits—except NO liquids, or striping tape. Dwarfs are 2/3 the size of the ¾" models. If ordering Dwarfs direct, 10c extra for handling must be included, unless 6 or more are ordered. Above is given the list of Dwarfs of the models shown on this page. These Dwarfs are the "talk of the model world."

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XUM

The World's Planes and Builders

(*Continued from page 60*)

	Breda 39.	2-seat lightplane for the private owner.
	Breda 42.	Revised Breda 39.
	Breda 44.	6-passenger cabin biplane.
	C.M.A.S.A. M.F.5.	2-engine all-metal commercial 10-passenger flying-boat.
	C.M.A.S.A. M.F.6.	2-seat fighter and all-metal flying-boat for catapulting from shipboard.
Construzioni Meccaniche Aeronautiche, S. A., Marina Di Pisa.		
Compagnia Nazionale Aeronautica, Via Sistina 23, Rome.	C.N.A. "ETA".	2-seat lightplane.
	C.N.A. "Delta".	2-engine commercial plane.
Cantieri Riuniti Dell'Adriatico, Monfalcone, Trieste.	Cant 21bis.	2-seat observation flying-boat.
	Cant 22.Ri.	3-engine 9-passenger flying-boat.
	Cant 25M.	1-seat shipboard fighter flying-boat.
Societa Italiana Caproni, Via Mecenate 76, Milan (Taliedo).	Caproni 97.	1 or 3-engine 6-passenger commercial or military transport monoplane.
	Caproni 97-Hydro.	Type 97 fitted with twin duralumin floats and a 500 h.p. "Jupiter" engine.
	Caproni 101.	3-engine, enlarged model of Ca. 97.
	Caproni 102.	Similar to the 101, but fitted as a bomber with two 500 h.p. "Jupiter" geared engines.
	Caproni 105.	4-passenger cabin monoplane.
	Caproni 109.	2-seat training biplane.
	Caproni 111.	The type 101, fitted with one engine and equipped as a long-range observer.
	Caproni 113.	2-seat advanced training biplane.
	Caproni 114.	Single or 2-seat fighter.
	Caproni 125.	2-seat lightplane for private owner.
Aeronautica D'Italia, Turin.	Fiat C.R.20bis.	1-seat fighter biplane.
	Fiat C.R.20bis Seaplane.	1-seat fighter convertible into a fighter seaplane.
	Fiat C.R.20 Two-Seater.	2-seat biplane trainer.
	Fiat C.R.30.	1-seat fighter biplane.
	Fiat C.R.32.	A development of the CR-30.
	Fiat C.R.40.	A CR-30 type fitted with a radial air-cooled engine.
	Fiat A.120.	2-seat observation monoplane.
	Fiat B.R.3.	2-seat bomber biplane.
	Fiat G.2.	6-seat commercial cabin monoplane.
	Fiat G.5.	Dual control 3-seat monoplane for primary training.
	Fiat G.8.	Dual control 2-seat biplane for normal and acrobatic training.
Aeronautica Macchi, Varese.	Macchi M-41 BIS.	1-seat fighter flying-boat.
	Macchi M-71.	1-seat fighter flying-boat especially developed for use on warships and for catapult launching.
	Macchi-Castoldi 72.	High-speed racing seaplane.
Piero Magni Aviazione, S.A.1, Aeroporto Taliedo, Strada Paullese, Milan.	Vittoria.	Sport monoplane.
Societa Anonima Piaggio & C., 2-12, Via Petrarca, Genoa.	Piaggio P-6ter.	2-seat observation seaplane, catapult type.

(*To be continued in our next issue*)

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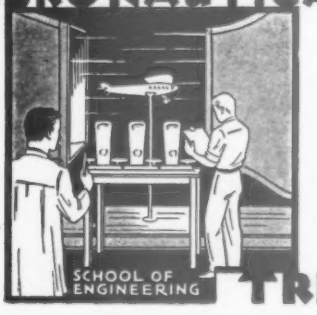

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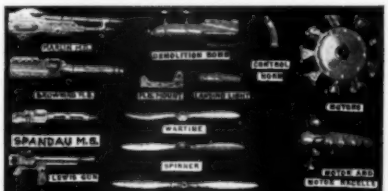

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4"	ST.....25c	6"	SP.....50c	3"	ST.....25c
5"	ST.....30c	2"	W.....15c	4"	ST.....30c
6"	ST.....35c	2½"	W.....20c	5"	ST.....40c
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(*Continued from page* 16)

The flying part of the survey of Connecticut was started on April 4, 1934, after the snow had left the ground and was completed May 27, after 153 hours of flying time before leaves had come out on the trees enough to obscure important landmarks. In order to complete the work within the alloted time, four planes were used.

Three of them were Fairchild cabin monoplanes and the fourth was a two place observation plane of the 43rd Division, Air Service, Connecticut National Guard. The four planes were each fitted with a standard Fairchild K-3 aerial camera with a focal length of 9½ inches.

This type camera is widely used in this country as well as abroad for both vertical and oblique pictures in all phases of commercial, industrial, and military aerial photography. (In photographing Massachusetts, a five-lens, Fairchild T-3A camera was used in a Fairchild "71" cabin monoplane.)

In connection with a review of the activity of Fairchild, it is interesting to note that the Tennessee Valley Authority is basing all its planning on maps derived from aerial photogrametry. This particular aerial survey covered an area of some 40,000 square miles. Ten thousand composite photographs were taken with a Fairchild five-lens mapping camera operated by the Aero Service Corporation of Philadelphia during eight months of actual flying.

The demand for the maps was so great that extra men were assigned to the ground work in order to complete the project in six months, a full year ahead of schedule. The same mapping by conventional means would have required several decades and would have cost several times as much as the project.

In all, Fairchild has airmapped Connecticut, Massachusetts, and New Jersey, as well as practically every large American city. In the filing cabinets of the Fairchild Aerial Surveys building at Woodside, Long Island, are more than 200,000 aerial pictures. There may be had aerial photos of almost every hamlet in the United States, and every city of importance in the world. The "shots" range from Venezuelan oil fields to Canadian timber lands, from desert wastes to Mayan ruins. Prices for such aerial mapping and photography range anywhere from $1 to $450 per square mile, depending upon just how much and what kind of detail is desired. Or, if you wish, you may buy your own aerial camera, prices for them range from $313 up to the new $26,000 job.

Many pilots are availing themselves of apparatus as this promises to be one of the most profitable fields of aviation.

By means of these maps, expert oil men from these companies hope to locate the geologic domes which usually mark petroleum deposits, thus saving the vast amounts of time and money which would be expended through ordinary prospecting. Already natives are hacking out landing fields in the jungle for the four Ford trimotors which will carry the cameras and by early Fall actual work will begin.

Fairchild, by hard work, honesty, and common sense has made a name for himself in aviation and there is every indication that there are big things ahead for him. For one thing, he is sending cameras to twenty-three countries, and for another and perhaps as good a reason, only about one-third of the entire area of the United States has been adequately mapped to date and the mapping of the remaining two-thirds undoubtedly will be done by means of aerial cameras.

END.

NEW BOEING P 26 A ARMY FIGHTER

WITH NEW TYPE FINISHED HOLLOW BALSA FUSELAGE

World's Easiest Model to Build

N E W

N E W

22" Span. Length 18". Weight 2¾ oz. ¾" Scale.

For those who prefer to do the least amount of work in building a sensational and exclusive model we have produced this model with a completely finished strong hollow balsa fuselage made by special exclusive process with built-in headrest and wing stubs, also rubber motor already installed. An exact scale copy from factory plans of one of the fastest and best streamlined ARMY fighters ever produced. This is a flying scale model.

Set includes finished fuselage just as pictured below, also 3" 9-cylinder celluloid motor, a 3¼" special tapered spun aluminum cowl, celluloid wheels, 8" steel type carved propeller, aluminum motor plate, tail wheel, printed wing, rudder and tail ribs, pants, etc., insignia, yellow and blue dope, paint, glue, scale drawing, etc. This model is a good flyer and a masterpiece of beauty. Construction Set Complete, postpaid..... $4.50

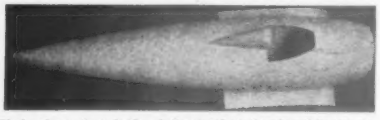


Photo of new type hollow balsa fuselage furnished in set as shown with built-in headrest, wing stubs and rubber motor already installed.

Advantages of hollow balsa fuselage

1. Fuselage will not warp or twist.
2. Takes glasslike finish.
3. Unsurpassed streamlining.
4. Model can be finished in a few hours.
5. Finished model a showpiece.
6. Exclusive—not obtainable elsewhere.

MINIATURE AIRCRAFT CORPORATION

83 Low Terrace New Brighton, New York

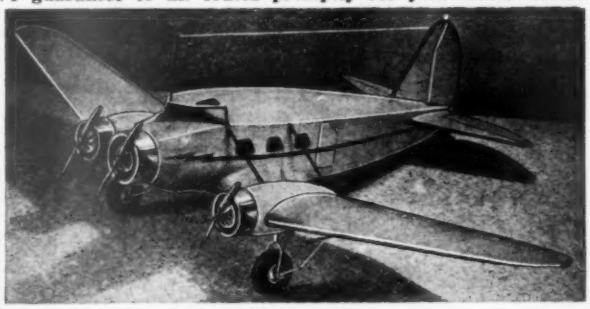
CAMERA WANTED

I want a high-grade miniature camera in good condition such as a Leica. Carl Zeiss Contax, National Graflex, Ikon Super-Nettel, Rolleiflex, etc. Must be reasonably priced.

Box 100
Popular Aviation
608 S. Dearborn St. Chicago, Ill.

Here's Construct-A-Planes' Christmas Gift to Model Builders . .

New! To fulfill the popular demand for new models, CONSTRUCT-A-PLANE is happy to present to you this grand ensemble which includes 12 brand new numbers. Look them over and make your choice. **We guarantee to fill orders promptly for your Xmas needs.**



The Gem of The Air

37½ Inch Wing Span

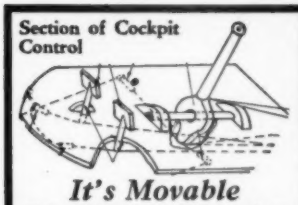
The picture shows what a beauty this Stinson air liner is . . . . no words needed to describe it. Our engineers completed this in absolute true scale. Has aluminum cowlings, 3 celluloid motors, real electric lights, movable controls, all accessories and supplies, book of simplified plans in exact detail showing you how to build accurately and easily step by step.

$4.50

SPECIAL

We also have the BOEING F4B4 —37⅛" wing span price $5.50

Section of Cockpit Control



It's Movable

This sectional cut shows you how Gold Seal cockpit movable control operates. Precision made by expert airplane engineers . . . easy to install with the Gold Seal simplified ABC plans . . . you'll get the kick of real flying with this new feature. Joy stick, foot pedals, pulleys, horns, etc.

6" to 8" Replica Models

All finished in colors.

Gee Bee, Sikorsky, Amphibian, Mystery S. Racer, Fairchild 24, Howard Racer, Boeing P-12C, Nieuport 17 C-1, Curtis Hawk P 6E, Savoia, Marchetti, Fokker D-VII, Sopwith Triplane, Spad, Northrop, Gamma, Supermarine, SE-5, Pfalz, De Haviland IV, Lockheed Vega, Hell Diver, Waco, Albatross.

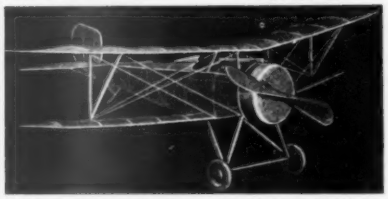
15c Ea. Postpaid

Now Build The Famous SMILIN' JACK Air Circus 10c EACH

Some fun building this Smilin' Jack and seeing it as an actual solid replica. It is the famous **Stratoplane Smilin' Jack—** only **10c**

Here's the **Smilin' Jack Flivver Plane—** another scoop for us—easy to build with our simplified plans and complete kit— only **10c** Postage 5c extra (Canada 10c extra) for all Smilin' Jacks

Smilin' Jack's Air Taxi—you will be proud to complete this solid replica to complete your Smilin' Jack's Air Circus. All Smilin' Jack's 7 to 8" only **10c**



8 New 26 in. Flying Models

Here are 8 new models—test flights prove them to be record breaking flyers. Furnished complete postpaid with CONSTRUCT-A-PLANE'S recognized most simplified plans and all complete parts and supplies. You'll get a new thrill in model airplane building in completing one of these new 26" flyers.

30c Ea. POSTAGE FREE

Your choice of: Ryan S-T Sport Trainer, Monocoupe 90-A, Rearwin Speedster-6000, Fairchild 22, French Nieuport XVII C.1.—Fokker D-8, Stearman 73 U. S. Navy Trainer, Curtis Hawk U. S. Army Pursuit.....

16" FLYERS FAIRCHILD 22

FORMERLY 30c..XMAS SPECIAL 15c Contains printed balsa parts, two colors tissue, wheels, wire, rubber, wood veneer, full-size plan, dope, cement, etc., 8 models to choose from: Geehawk, Fokker, Triplane, Fokker D-1 Fairchild, Curtis Falcon, Howard Ike, Waco Nieuport.

15c Ea. Postpaid

Our Famous 24 in. Gold Seal Line

This line has a new movable cockpit control. Kit contains horns, pulleys, and hinges, ¾ finished wheel pants, two colors tissue, all parts printed on Balsa, aluminum spun cowl, finished prop. Fully detailed plan and complete instructions, cement, dope, etc. Most elaborate kits ever offered. Price

$1.00 Ea. plus 15c postage (Canada 25c postage).

Choose from: Curtis Swift, Spad, Douglass 638, Albatross D 5A, Hell Diver, Stinson Reliant.

Outstanding 20" Flyers — Big Value!

Here are 4 record breaking 20" flyers—talk of the model world. Kit contains full size plans and instructions, all printed parts, cement, colored tissue, wire, rubber wheels, strips, etc. **Choose from: Heath Parasol, Verville Air Coach, Commander, Drigg's Skylark.** Price

50c Ea. plus 10c postage. (Canada 15c postage.)

12" SOLID REPLICA MODELS

With die-cast propeller, two bottles color, cement, printed balsa parts, etc. 10 models to choose from: Douglass, Gee Bee, Fairchild 24, Bristol Fighter, Monocoupe, Spad, Aeronca, Boeing X P 936, Stinson, Flamingo.

30c Ea. Postpaid

HOW TO ORDER . . . .

Send name and address. Mention planes wanted. Enclose amount and postage. Write clearly. On Canadian and foreign orders add 10c to each order under $1, and 15c on all orders over $1.

Construct-A-Plane Co., Dept. 701

738 Grand Street - - - Brooklyn, N. Y.

Hangar

(*Continued from page 40*)

This steel siding has a V-crimp at each outer edge, and these crimps overlap two inches. The siding is nailed directly to the rafters and studding, using self-sealing lead-headed nails that automatically make a waterproof joint.

Since four sliding doors might have imposed sufficient weight on the track support to spring or break it, only the two center doors, each 7½′ wide, were made to slide. The side doors are ten feet wide and swing on strong 14″ strap hinges. For lightness, the framework of the doors should be of poplar or some other light wood, 1″x6″, and the panels of ¼″ plywood.

This plywood, although thin, is very durable and when painted will last for several years. Plywood should not be exposed to weather until after waterproofing. The bottoms of the sliding doors move along the front sill in a recess that acts as a guide.

So that this hangar wouldn't be condemned in the first Clean-Up-The-Town movement that came along, and so that I could spot it for miles away while I am in the air, I put on a coat of weatherproofing aluminum paint. It protects the steel and plywood from erosion and decay, gives the shed a professional finish that will never tarnish.

Below is an itemized resume of the costs. I'm not naming the places where you can buy the materials at the prices quoted, because the Advertising Manager is funny that way. But I surmise that if you write the Editor, enclosing a stamped, self-addressed envelope, he'll be glad to give you the dope.

Lumber is quoted at the average current market price, but should be obtainable at lower than these figures in most communities, since this estimate was purposely made liberal. Count it up on your own fingers. Does it total $99.75, or do I move to the foot of the class?

END.

Dictionary

(*Continued from page 28*)

FUZZY TONE. An indistinct distorted radio signal having a mumbling hollow tone due to poor modulation at the station.

(G)

g. The measure of the force created at the end of a dive or pull-out.

GABBY-MIKE. Anyone talking unnecessarily over the radio communication system between the plane and ground.

GADGETS. Any small auxiliary parts of a plane or engine.

GADGET-MAN. A mechanic or repair man who works on the small auxiliary parts such as the instruments, radio, engine accessories, etc.

GAFFER. The boss or officer in charge.

GAUGE-BUG. An absolute believer in the infallibility of instruments.

GAP. The distance between the upper and lower wings of a biplane.

GAS. Abbreviation for gasoline.

GAS BAG. A balloon.

GASSING. Filling tanks with gas.

'GIRO. Nickname for Autogiro.

GIVE HER THE GUN. To open the throttle wide and develop full power. "Stepping on the gas", is the automobile equivalent.

GLIDE. To descend along a sloping downward path propelled by gravity.

GLIDER. A plane without an engine, propelled by gravity.

GLIDE-STRETCHER. A mythical device for increasing the angle of glide. This can only be accomplished by the application of power.

GO BLACK. Loss of sight due to centrifugal force driving blood out of head when pulling out of a steep dive.

GOO. See DOPE.

GOSPORT SYSTEM. Communication system between the student and pilot.

G-PLANE. A plane in the government service, usually a ship flown by an inspector of the U. S. Department of Commerce.

GRASS-CUTTING. Flying a plane close to the ground.

GRASS-MONKEYS. Gophers, rabbits or other burrowing animals that destroy the surface of the airport.

GREASEBALL (GREASE MONKEY). An assistant mechanic or handy man. Also the oiler and plane washer.

GROUND. Orders by government prohibiting a pilot or ship from flying. A man or ship may be "grounded" by the inspector.

GROUND-LOOP. Loss of directional control on ground that causes an airplane to whirl about suddenly in a circle.

GROUND-SCHOOL. A school in which the principles, theory, mechanics and other flight subjects are taught that do not require actual flying practice.

GRUDGE-JUMPER. A parachute packer that is challenged to jump with the chute that he has just packed. In the army, a pilot can compel the packer to jump with his chute in case that he believes the packer has purposely mispacked the chute.

GUN. The engine throttle.

(H)

HALF-LOOP. A partly completed loop due to insufficient speed.

HAND. Direction, left-hand or right-hand.

HANGAR. A shed or building for the storage of aircraft.

HANGAR FLYING. To detail one's thrilling experience while safely on ground. Comparable with fish stories, etc.

HANG-UP. To stall by holding the nose up with engine cut.

HANG ON PROP. To point the nose straight up with the engine full on, the prop partly supporting the ship.

(*to be continued next month*)

New! This Amazing Addition to Model Aviation

LILLIPUT LIGHTING KIT FOR AIRPLANE & SHIP MODELS

Note Navigation Lights

Wire up and illuminate models with real navigation lights.

Genuine Midget Electric Bulbs, only 7/32″ diameter, burning on any 2 cell battery.

CONTENTS OF KIT: 3 Lilliput Pea-Lamps, 1 red, 1 green, 1 white, each with 22″ specially thin flexible wire-cord; 1 miniature base connecting-plug to fit any flashlight or electric lantern or penlite; complete instructions for installation, (or all 3 lamps white if desired for cabin or landing lights). Satisfaction Guaranteed. If Local Dealer cannot yet supply we will mail you complete Kit postpaid for..... **85c**

Dealers interested in carrying our line write:

HELIOS PRODUCTS CORP.

799 Broadway Dept. P1 New York, N. Y.

36" FLYING KITS...*and, boy, do they FLY!*

(Shown Above) **CURTISS GOSHAWK** *Add 25c Postage* **$1.00**

(Upper right corner) **FOKKER D-VII** *Add 20c Postage* **75c**

(Shown at right) **CORBEN SUPER-ACE** *Add 20c Postage* **75c**

Free offer not included with these kits.

Complete—nothing else to buy. Best quality materials and plenty of them. Plenty of dope, cement, AA Jap tissue. Grade A balsa, printed rib sheets, printed formers, wire parts formed, finished propeller, real scale full-size 36″ wingspan plans.

18 IN. LENGTHS
1/16x1/16 ...100 for 5c
1/16x1/8 .... 35 for 5c
1/8x1/8 ..... 30 for 5c
1/8x1/4 ..... 10 for 5c
1/4x1/4 ..... 5 for 5c
1/2x1/2 ..... 2 for 5c

18 IN. SHEETS
1/32 or 1/16x2..8 for 10c
1/8x2 .....6 for 10c
1/4x2 .....3 for 9c

18 IN. PLANKS
1x1 1 for 4c|2x2 1 for 18c
1x2 1 for 10c|2x3 1 for 23c

JAP TISSUE
1 doz. all col., AA..19c

SILVER TISSUE
20″x24″ .....each 5c

SUPER-FINE TISSUE
White Only
Sheet, 5c; dozen, 50c

DOWELS
1/16x6 .....doz. 5c
⅛x18 ..... 2 for 5c

BALSA WHEELS
½″.. 3c ⅝″.. 4c
1″.. 5c 1½″.. 7c
3″ ..10c 5″ ..17c

BIRCH WHEELS
½″.. 2c ⅝″.. 3c
1″ .. 4c 1½″.. 5c
2″....10c

WIRE
2 ft. 1c 25 ft. 10c

INSIGNIA SHEETS
24 insignia and stripes 5c

WASHERS
1 doz. ⅛ or ¼... 1c

PROPELLER BLOCKS
⅛x ¾x 6...6 for 5c
⅛x1 x 7...3 for 5c
¼x1 x 8...3 for 5c
¼x1¼x10...2 for 5c
¼x1¼x12...1 for 4c
1 x1¼x12...1 for 7c
1 x1½x15...1 for 9c

SHEET ALUMINUM
.005 in., 6x6.....5c
.010 in., 6x6.....6c

CLEAR DOPE
1 oz...5c ½ pt...30c

COLORED DOPE
1 oz. bot., all col., 5c

CLEAR CEMENT
1 oz. bot. 5c; 2 oz. 10c
½ pt. bot.....35c

FREE With every order of $1.00 or over postpaid—2 oz. bottle CLEAR CEMENT and 100 1/16x1/16x18 BALSA STRIPS

MACHINE-CUT PROPS
5″.... 5c 6″... 6c
7″.... 7c 8″... 8c
10″...10c 12″...12c

BAMBOO
1/16x1/16x12
36 for 5c
1/16x¼x15 ..ea., 1c
doz. 10c

THRUST BEARINGS
Small, doz. 10c
Large, doz. 15c

RUBBER
1/16x1/16 ..18 ft. 5c
⅛ flat .....15 ft. 5c

WOOD VEN. PAPER
20x30 .....1 for 10c

SHEET CELLULOID
6x8...5c 12¼x16..20c

MODEL PINS.
pkg. 5c

THINNERS, 1 oz. 5c

Postage paid on all orders in United States for 75c or over, except west of Miss. add 10%; Canada and Foreign, add 15%. Under 75c, add 15c. Send 3c stamp for illustrated catalog (free with orders). NO STAMPS. NO C. O. D's.

REED, 2 ft.....1c
BUSHINGS, 1 doz. 3c
SANDPAPER, pkg. 5c
PROP SHAFTS, doz. 8c
NOSE PLUGS, doz. 10c

Dealers, Clubs, Schools: Send for Wholesale List

DUMMY RADIAL ENGINE
1½″ d. 18; 2″ d. 23; 3″ d. 33

ENGINE AND COWL ATTACHED
1½″ dia. 20; 3″ dia. 35

CELLULOID WHEELS
⅝″ pr. 5c 1⅛″ pr. 10c
1″ pr. 7c 1⅜″ pr. 17c
3″ pr. 30c

CELLULOID PANTS
½″ to 1″.....pair 18
1⅛″ to 1⅞″....pair 33

ALUM. COWLINGS
1½″ 15c; 2″ 18; 3″ 25
Specify whether anti-drag, closed, or open.

BOMBS
¾″ 04; 1¼″ 07; 3″ 12

GUNS WITH RING MOUNT
1¼″....10; 1¾″....15

PURSUIT MACHINE GUNS
⅝″, 1¼″ or 1¾″, ea. 05

PROPELLERS

	2 blades	3 blades
1½″	.08	.10
2½″	.13	.15
3½″	.18	.20
4½″	.20	.25

WING AND TAIL LIGHTS
12″ 10c; 18″ 15c; 24″ 20c

20 IN. FLYING PLANS 10c—3 for 25c
Sparrow Hawk, Boeing Trans. 247, Spad Chass., Vought Corsair, Curtiss Swift L. W., Waco Cabin Biplane, Douglas Delphin, Boeing P12F, Fokker D-VII, S.E.5, Goshawk, Gee Bee.

IMPERIAL MODEL AERO SUPPLY
Kensington Sta.,
416 McDonald Ave.. Dept. A, Brooklyn, N. Y.

ARE YOU INVENTIVE

INVENTORS: Send immediately for your copy of our big, new **Free book, "Patent Protection."** Forty-eight pages of interesting facts. Tells how Patent Laws protect you; kind of sketch or model needed; simple steps to take without cost; how successful inventors have secured financial assistance; shows interesting inventions; illustrates important mechanical movements. **Other men have read and profited by this book.** With book we also send **Free Evidence of Invention form,** that you can use to establish date of disclosure. Prompt service, reasonable fees, special deferred payment plan. Strictest secrecy. Thirty-six years' experience. Highest references. Write us today. The facts in our book are worth money to the man with a good invention. Address: **Victor J. Evans & Co., Registered Patent Attorneys, 727-A Victor Building, Washington, D. C.**

Classified

PHOTOGRAPHS—Aviators, Planes, Celebrities, Scenic. All sizes. Sample and price list, 10c.—Ralston Photos, 612 No. Denny, Indianapolis, Ind.

USED AIRPLANES $50.00 AND UP—Literature 10c.—Continental Sales, Box 344, Dept. 11, Indianapolis, Ind.

PHOTOGRAPHS of British and European Air Liners. Post card size 20c each, $1 per ½ doz., $1.50 per doz.—Line 35, Ridgemount Ave., Coulsdon, Surrey, Eng.

BALTRUN (Baltrun) Special 1 place, Leblond motor 71 hrs., repossessed $325.00. OX5 motor, Scintilla Mag. $50.00. 1 Set Lightplane wings $25.00. Waco Radiator. All parts for Waco, Travelair, N. B. Trainer cheap. Pair 30"x5" wheels, tires, tubes, discs $10.00.—LaFleam Airport & Flying Service, Northampton, Mass.

HUNDREDS OF USED PLANES, motors, crackups, every price, type and location. OX jobs $100.00 up. Complete Directory with owner's price, name, address rushed for 20c postpaid.—Used Aircraft Directory, Athens, Ohio.

AMAZING BARGAINS — SZEKELY 30 H.P. $95.00; ANZANI 3 cyl. $85.00; LAWRENCE $35.00; Converted HARLEYS $36.50; 1929 INDIAN Scout motor for Midget Auto $15.00; EVANS Bicycle motor $4.50; 2.50x12.75 Balloon Tired Midget Auto Wheels (4) $16.00; LISTS 6c. Write at ONCE.—AERO SHOP, Box 164, Pottstown, Pa.

BUILD YOUR OWN Midget Car or Lightplane from Storms Plans. Engines, air propellers, hubs, 20x4 tires, wheels, etc., at bargain prices. Circulars 10c.—STORMS AVIATION CO., 13 Southside Ave., Asheville, N. C.

CABLE SPLICING INSTRUCTIONS. $1.00.
A. G. BRETON, 163 Virginia St. Hillside, N. J.

Aero-Sportswoman

(*Continued from page* 40)

the first degree. This time must include landings at five different airports and only one cross-country flight of about 200 miles.

There are absolutely no requirements made for either instruction or practice in any form of air maneuvers, or for ground school courses. Aerobatics are considered stunt-flying and have no place in the ordinary training course. Then, it is only necessary for a pilot to fly three hours a year to retain his license, which is one point at least, that is not approved of by two different instructors with whom we discussed the subject.

However, just because acrobatics do not come under the Aero-Club regulations, is no reason for thinking that the Frenchman does not know his power-dives and tailspins. END.

The FLYING FLEA
How To Build and Fly It!

COMPLETE instructions and detailed drawings for building this famous French lightplane. Authentic translation from the French of Henri Mignet, the designer. Profusely illustrated and absorbing book recommended to everyone interested in aviation. Price $3.00 postpaid. Imported from England.

Popular Aviation 608 S. Dearborn St. Chicago, Ill.

Barter and Exchange

Notices in these columns are confined to trades. Cash sale advertising must be inserted under the Directory or Classified columns. Notices in the Barter and Exchange columns, three cents per word.

AIRPLANES

FOR SALE OR EXCHANGE—KR-31, needs covering and dope for fuselage and dope for upper wings. Also L. N. Heath fuselage with controls. Want small ship that is eligible for N. C. License with few repairs.—H. F. Jerregan, Nantucket, Mass.

FOUR PLACE CESSNA—Needs recovering, newly majored—J4 motor. Trade for Aeronca or like plane. Sell $385 or sell parts, wing $100, J4 motor $150, landing gear $25, etc.—A. C. Hoffman, Box 283, Denver, Colo.

SALE OR TRADE—Heath Center Wing in flying condition, 5 hours on new Henderson motor and prop. $150.00 cash or consider good OX powered airplane with N. C. license or any two or three place ship with N. C. license, have $150.00 to boot.—Charles Steckevicz, Pelham, New Hampshire.

FOR SALE—Nicholas-Beasley 2 Pl. Open Monoplane. 80 HP Genet. 85-90 Cruise 110 Top. Just overhauled. Licensed. A bargain. Plymouth Coupe considered.—A. Otbadovec, 2212 S. 61st St., Cicero, Ill. Harrison 8768.

FOR SALE OR TRADE—Davis V-3 Special LeBlond 65 Speed Ring. Cockpit cover, extras. Was advertised for $750, but it now needs right wing panel. Motor no time since overhaul, 475 hrs. total time. A real ship.—Cedric Galloway, Austin, Minn.

TRADE—Month old primary glider, flown 30 times, excellent performance, for Salmson 40-50, Seckelzy 45, or equivalent. If motor has propeller or is in excellent shape will include "Indian Twin" with new propeller, hub and motor mount.—Bob Meyer, Pewaukee, Wis.

HAVE Stinson SB1. Uncovered, less motor, Harley '34 Big Twin. Want small open ship.—Alfonso Martinez, 20 West Huron, Chicago, Ill.

SALE OR ? ?—One Clark Y, two piece, takes wing tail group and landing gear for two place ship in perfect condition, off of licensed ship also some dope, tubing, etc.—F. G. Clark, P. O. Box 260, Hutchinson, Kan.

WANTED—One or two-place sportplane such as Taylor Cub, Heath or similar ship with engine. Must be licensed. No crack-ups considered. Send complete description and photograph first letter. Will trade 5 acres Michigan land suitable for summer home, soil cultivation, hunting and fishing.—Dr. B. E. Blanchard, Jr., 303 Astor Court, Villa Park, Ill.

DREGGS SKYLARK—Rover motor, private owned, ship just motor overhauled at factory. Semi air wheels, brakes, winter enclosure, instruments. Take ship or light car on trade.—Floyd Crocker, 1109 E. Leonard St., Grand Rapids, Mich.

MISCELLANEOUS, ETC.

SWAP—.32 revolver, for a pair of good binoculars.—E. Kent, 143 Peter St., Buffalo, N. Y.

SELL OR TRADE gas model engine with tank, $5.00—also one eighteen foot Navy parachute, $5.00. Want fifteen ribs of 3½-foot chord.—Kenneth Goodsell, 26 Highland Ave., Bethel, Conn.

WANTED—Four complete York Barbell Courses; trade magazines or cash.—Vincent Palumbo, 64 East Broadway, New York City.

FOR SALE OR TRADE—Complete Popular $75.00 Hinton course in the theory and principles of Aeronautics. $18.00 cash or some Aviation textbooks.—W. La Monte Garrett, 136 S. 29th St., Lincoln, Neb.

TRADE OR SELL—Chevy powered ice sled. 70 M.P.H. A-1 shape.—Orlande Toole, Laurens, Iowa.

8"x10" Hand Printing Press wanted. Have books, balsa wood, a 4" swing wood lathe, radio parts and soccer ball.—Edmond Emminger, Jr., 2748 Tivoly Ave., Baltimore, Md.

WINTER flying suit sheepskin lined, size 38. Ground course Commercial Aeronautics, fifty volumes. Will sell or consider machinist tools in trade.—Walter Skelton, 336 Arlington Ave., Waukesha, Wis.

DESIRE financing through transport pilots course. Exchange for my services. Age 20. High school education. References.—James R. Kufner, General Delivery, Phillips, Wis.

TRADE—Lawrence Airplane motor. Good as new and complete trade for four (4) cylinder motorcycle.—C. Marsh, 1710 Gatewood, Oklahoma City, Okla.

WILL accept your car, motorcycle, glider, plane, engine, or what have you, as part payment on complete flying courses. Choice of three types of Government Licensed ships. Transport Instructor. Dual Instruction, solo, radio beam, blind or night flying by the hour. Instruction on the largest exclusive student flying field in the south—at lowest prices. Free room offered in $75,000 brick hangar.—Grand Prairie Flying Service, Dallas-Ft. Worth Highway, Grand Prairie, Texas.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

OF POPULAR AVIATION, PUBLISHED MONTHLY AT CHICAGO, ILL., FOR OCTOBER, 1935.

State of Illinois } ss.
County of Cook }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared R. Geo. Davis, who, having been duly sworn according to law, deposes and says that he is the Editor of the Popular Aviation and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Aeronautical Publications, Inc., 608 So. Dearborn St.; Editor, R. Geo. Davis, 608 So. Dearborn St.; Managing Editor, J. B. Rathbun, 608 So. Dearborn St.; Business Manager, A. T. Pullen, 608 So. Dearborn St.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Aeronautical Publications, Inc., 608 So. Dearborn St.; W. B. Ziff Co., 608 So. Dearborn St.; W. B. Ziff, 608 So. Dearborn St.; David Ziff, 608 So. Dearborn St.; B. Geo. Davis, 608 So. Dearborn St.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and security in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

Sworn to and subscribed before me this 25th day of September, 1935.

A. T. PULLEN
(Signature of editor, publisher, business manager or owner.)

M. GNASS
(My commission expires February 26, 1936.)

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Reliant

(*Continued from page 28*)

is equipped with a 9-cylinder Lycoming engine developing 225 h.p., while the Model SR6-B is powered with the 260 h.p. Lycoming engine which necessitates larger gas tanks and which weighs 225 pounds more than the standard Reliant. The larger engine adds about 4 m.p.h. to the cruising speed and a 1,500 higher service ceiling. Both planes are provided with Smith-Lycoming adjustable pitch propellers as standard equipment.

A glance at the landing-gear will show a particularly clean arrangement for we see only two "legs" exposed to the airstream, carefully streamlined, in place of the more common clutter of external bracing that takes its toll of the power and speed. The tubular struts carry the wheels at onen and at the upper end are hinged to the fuselage. The inner extensions of the tubes are connected to Aerol fluid shock absorbers so that all parts of the mechanism are entirely enclosed within the fuselage.

Full N.A.C.A. cowling on the motor, pants and well filleted connections between the various external parts all help in reducing the resistance.

Soaring

(*Continued from page 37*)

In view of what some glider bugs may think, Major Carroll Cone is for gliding and soaring. He proved this in Elmira, N. Y., during the last National Soaring Meet. He informed the members of the Soaring Society of America, that he was ready to appoint someone to the Bureau who knew gliders and gliding and would be capable of handling the situation for the Department.

It is now up to all interested persons to see that the position is filled, and by someone who will do us some good. You owe it to yourself to have that man in there.

Many of the fellows who attended the Sixth National Soaring Meet, wrote to me and were pretty sore because their names, or the names of the Clubs which they represented, were not mentioned in my article concerning this Meet. One of these individuals even went so far as to say that I was hogging the page with a photo of myself.

I hate to disappoint this fellow, but I had nothing to do with the pictures which appeared on that page, and had not seen either one of them until the proof came back from the printer. Pictures which I made at the meet will appear from time to time in future issues, so there. . . . I hope all your children turn out to be radio amateurs.

As more proof that the gliding and soaring World is again holding its head up, let me tell you a few things that have happened since I first began writing the National Glider Movement for POPULAR AVIATION last December.

My report shows that forty-three clubs were organized under the movement, all of which have gliders in the air, or under construction. Sixteen new ships have been purchased, 12 second-handed jobs have changed hands, and as many as 114 fellows have succeeded in making their 500 foot hops and 360 degree turns.

This doesn't sound bad at all. I feel sure that if the Bureau accepts my suggestion as to the new Home Builders License, the above report will be five to ten times greater in the next six months.

The annual Big Meadows Soaring Expedition was held from September 27th to October 13th. Big Meadows is located at an elevation of 3,500 feet in the Blue Ridge Mountains, 2,500 feet above the valley floor, in the Shenandoah National Park, just a few miles south of Luray, Virginia. Luray is located approximately 100 miles southwest of Washington, D. C., and can be reached over excellent roads from almost any point of the compass.

The soaring ridge extends from this point northeast and southwest at an elevation of 3,000 feet for more than 100 miles in both directions. This soaring meet is supervised each year by the Soaring Society of America.

As this game develops, there will be plenty of soaring ridges for clubs in all parts of the country.

END.

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1/16x3/16 .....24c
1/16x1/4 .....26c
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3/32x3/32 .....24c
1/8x1/8 .....23c
1/8x3/16 .....48c
1/8x1/4 .....52c
3/16x3/16 .....65c
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2x2 .....each 23c
2x3 .....each 32c

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1/64x2 ....10 for 14c
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3/16x2 ....10 for 31c
1/4x2 ....10 for 40c

SHEETS 3" WIDE Double these prices.

PROP. BLOCKS PER DOZEN

½x¾x5 ..... 5c
½x¾x6 ..... 5c
⅝x1x7 ..... 14c
⅝x1x8 ..... 17c
¾x1¼x10 ..... 29c
¾x1¼x12 ..... 34c
1x1½x12 ..... 38c
1x1½x15 ..... 52c

BALSA BALLOON WHEELS

½" .....doz. 9c
⅝" .....doz. 11c
¾" .....doz. 14c
1⅛" .....doz. 19c
1⅞" .....doz. 35c
3" .....doz. 75c

BIRCH WHEELS LIGHT and STRONG

½" .....doz. 5c
⅝" .....doz. 8c
¾" .....doz. 8c
1⅛" .....doz. 10c
1⅞" .....doz. 15c

NOSE BLOCKS

1x2x1 .....doz. 6c
2x2x1 .....doz. 12c
3x3x1 .....doz. 20c
3x3x2 .....doz. 39c

CELLULOID WHEELS

¾" .....doz. 24c
1" .....doz. 25c
1⅜" .....doz. 35c
1⅞" .....doz. 60c
3" .....doz. $1.50

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12 pkgs. ..... .25c

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1/16x1/4x15 per doz. 8c
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1000 .....$3.50

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CLEAR CEMENT, DRIES QUICKLY, BEST QUALITY

1 oz. bottle.. doz. 45c
2 oz. bottle ..doz. 80c
2 oz. tubes. doz. $1.00
½ pint .....each 35c
1 pint .....each 45c
1 qt. .....each 75c
½ gal. $1.25
1 gal. ....each $2.00

CLEAR DOPE

1 oz. bottle ..doz. 44c
2 oz. bottle ..doz. 80c
½ pint .....each 25c
1 pint .....each 40c
1 qt. .....each 65c
½ gal. 90c
1 gal. ....each. $1.50

COLORED DOPE

Red, White, Blue, Black, Orange, Silver, Yellow, Olive Drab, Cream, Gray, Khaki.
1 oz. bottle ..doz. 50c
2 oz. bottle ..doz. 90c
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1 pint .....each 50c
1 qt. .....each 85c
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1 doz. 11c
½ ream $2.50
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20x24....per doz. 21c

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⅛ brass O.D.....5c
⅛ copper, O.D....5c

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1/16 I. D. 15c

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Small .....doz. 8c
Large .....doz. 10c

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No. 8 .....23c
No. 10 .....25c
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HIGH GLOSS DOPE

2 oz. bot..doz. $1.25

CELLULOID DUMMY RADIAL ENGINES

1⅛" .....doz. $1.50
2" .....doz. 2.40
3" .....doz. 3.25

ENGINE AND COWL ATTACHED CELLULOID

1¼" .....doz. $1.50
3" .....doz. 3.75
½" to 1" Celluloid Pants ..doz. $0.80
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ALUMINUM COWLS OPEN, CLOSED OR DRAG

1¼" .....doz. $1.65
2" .....doz. 2.00
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⅝" Bombs..doz. .35
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3" Bombs..doz. 1.25
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PURSUIT MACHINE GUNS

⅝, 1¼ and 1⅝" $0.40

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12"...doz. sets $0.80
15"...doz. sets 1.50
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12¼x16..... each 15c
6x8.....doz. 45c

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1½" .....doz. $0.65
2½" .....doz. .70
3½" .....doz. 1.00
4½" .....doz. 1.25

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1½" .....doz. $0.70
2½" .....doz. 1.00
3½" .....doz. 1.25
4½" .....doz. 1.50

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1/32 dia...50 ft. 15c
1/16 dia...50 ft. 18c
3/32 dia...50 ft. 20c

DOWELS

1/16 dia. x 6" Gross 40c
1/8 dia. x 36" 100 for $1.50
1/8" x 36"— Each 2c
25 for 45c
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.003 .....5 ft. for 50c
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.0003 thick 3½ wide..25 ft. for 12c

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THE MOST EXCLUSIVE AND FINEST EQUIPPED MODEL IN THE WORLD

A special De Luxe model, one of the most beautiful and finely detailed ever made, with its special exact scale 3⅜" celluloid, 700 H.P. type, Wright Cyclone motor, having aluminum push rods, cylinder fins, etc., like real motor. Also in set are 4" aluminum cowl ring, 9" carved spruce semi-scale flying propeller, colored star and rudder insignia, 2" celluloid balloon wheels, silver dope, paint, black, red striping, Navy lettering, wire parts formed, axles, rubber motor, windshield, instrument board, flying wires, 4 aluminum step plates, aluminum wing walks, ready cut wheel pants, etc. All other parts printed on balsa. Detail scale drawing.
Construction Set Complete, postpaid..... $4.50

NEW LOCKHEED ARMY SPEED VEGA

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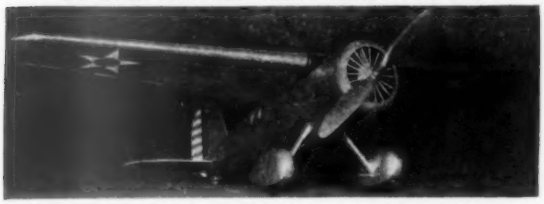

50" Span. Length 35". Weight, 14 oz. Color silver. 1¼" Scale

A new sensational flying scale model. Rises from ground in 15 feet and makes long steady flights. Const. set contains all formers and wing ribs cut out and notched for stringers, spars, etc., wheel pants ready cut, 3" turned balsa wheels, 5⅝" turned balsa cowl front, 15" carved varnished steel type propeller shown, 5 oz. silver paint, glue, etc. Even an amateur can make a perfect model of this with ease.
Construction Set, postpaid..... $8.50

Our models carry the finest and most expensive equipment of any made. Such parts as celluloid motors, balsa motor fronts, alum. cowls, celluloid wheels, carved propellers, one-piece formers, etc., make building easier. Motor sticks are not required in our models, saving a lot of work.

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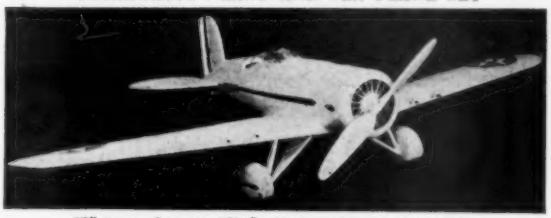
COMBINATION LAND AND SEA PLANE SET



32" Span. Length 22½". Weight 8½ oz. ¾ Scale

New 4-gun Navy fighter. Model will rise from land or water in few feet. Construction set contains fuselage and pontoon formers, wing ribs, tips, etc. printed on balsa, a 3⅜" turned cowl front, 2 instrument boards, colored insignia, lettering, windshields, 9" carved scale flying prop shown, 3 oz. silver paint, 1 oz. cement, ½ oz. black, 2 oz. glue, ready cut wheel pants, strong 2" aluminum wheels, 12 foot rubber, large 33"x44" drawing of land and sea plane. This is a sensational model and only one of its type in the world.
Construction Set in labeled gift box, postpaid..... $2.95

NEW BOEING F4B4 NAVY FIGHTER

22½" Span, Length 14½", Weight 2½ oz., Color, Silver and Yellow

This is the finest equipped Boeing F4B4 model in the world. New improved model exclusively equipped with new 3¼" special aluminum streamline tapered cowl ring, 9 cylinder celluloid motor with aluminum ventilator front, 8" carved varnished propeller, printed out balsa wood parts, silver dope, paper cement, glue, formed wire parts, celluloid wheels, tail wheel, U. S. Navy lettering, colored insignia, and ¾" scale drawing. **Construction Set Complete, postpaid..... $2.95**

NEW NORTHROP D2 ARMY PURSUIT

36" Span. Weight 4 oz. ¾" Scale

A de luxe set including 3" 9-cylinder celluloid motor, special 3¼" streamline tapered aluminum cowl, 9" steel type carved prop, all parts printed on balsa, silver paint, glue, tissue, aluminum, motor front, wheels, insignia, wire parts, tissue, and scale drawing.
Const. Set complete, postpaid..... $3.95

Curtiss Army Hawk P6E

24" Span. Weight 2½" oz. Colors drab and yellow

Set contains all parts printed on balsa, colored dopes, insignia, scale drawing.
Const. Set complete, postpaid..... $2.50

Northrop FTI Navy Fighter

22" Span, Weight 2 oz., Color Silver, ¾" Scale

Exact scale model of the Navy's latest 272 m.p.h. fighter. Set includes all parts printed on balsa, 3" turned cowl front, colored insignia, lettering, colored dope, drawing, etc.
Construction Set, postpaid..... $2.00

Douglas O45 Army Fighter

38" Span. Length 28". Weight 4½ oz. ¾" Scale

A beautiful large ¾" scale model of one of the latest army planes, capable of long flights. Set contains all parts printed on balsa, 2½" turned wheels, windshields, colored insignia, U. S. Army lettering, 2 oz. yellow paint, 1 oz. blue, 1 oz. clear, 2 oz. glue, etc., 24 nickel plated hollow exhaust pipes, a 10" carved scale 2 bladed prop, and full sized scale drawing, 33x44. Model has a removable motor box, and can win almost any flight contest.
Construction Set complete, postpaid..... $3.50

1/5 H. P. Gasoline Model Motor

Weight As Shown 12 oz.

Long life motor has steel cylinder and piston, ⅞" bore x 1" stroke. Comes complete with gas tank, coil, condenser, batteries. Price ready to run, complete, postpaid. Only $22.50
Motor comes mounted as shown. 15" or 19" laminated prop. for motor $2.75

BOEING F4B4 NAVY PURSUIT

1/5 H.P. Gasoline Motor Driven Model

68" Span. Length 44". 2¼" Scale. Color Silver

This is not just an ordinary large model, but one specially designed and engineered to stand the strain of the gas motor. The most realistic and life-like model of this size ever produced. As all the fuselage formers, wing ribs, tips, etc., are all cut out and notched for stringers, spars, etc., even a novice can make a perfect model of it with ease. Set contains 6" turned balsa wheels with bearings, rubber tail wheel, a special turned balsa 10" speed, cowl ring used on the latest Boeings, silk covering material, silver and red dope, glue, full size scale drawing, axles; all wood cut to size, etc. Weight of model with motor 3½ lbs.
Construction Set Complete, without motor, postpaid..... $25.00

NEW 1936 CATALOG. SEND 3c STAMP

A beautifully illustrated catalog, 8" x 10", ready November 15, 1935

California Dealer: JAYS MODEL AIRCRAFT, 7763 Melrose Ave., Hollywood, California

MINIATURE AIRCRAFT CORP., 83 Low Terrace, New Brighton, New York

Transatlantic

(*Continued from page 31*)

unknown with a ship that was not well adapted to the purpose. Brown and Alcock, an Englishman and an American, respectively, made their flight in a wartime Vimy-Vickers powered with two Rolls-Royce "Eagle" engines, blazing a trail across the North Atlantic that has been closely followed by the majority of later flyers. These men are the real pioneers and yet they received little in the way of recognition or financial reward.

Great Britain, always eager to reward her valorous sons, created "Sir" John Brown out of simple John Brown, but America was not so kind with her son Alcock. Evidently, Alcock did not possess the dramatic possibilities so desired by the papers, so he has become one of the many unknown soldiers that exist in this land.

And then there was Major Scott, the Englishman, who navigated the British dirigible, the R-34 to these shores and back again, thus enacting the first double crossing long before a Zeppelin touched these shores. Major Scott beat Dr. Hugo Eckener to a crossing by a good long time and yet this episode is also a forgotten incident.

And then there is Billy Brock of the Brock-Schlee team who flew the "Pride of Detroit" to Europe only two months later than Lindbergh, but these names are practically unknown to the general public.

William Brock, who died only a few months ago, was one of our earliest pilots and an Early Bird. He was held in great esteem and love by the oldtimers but he received little recognition and less money for his accomplishments.

Clarence Chamberlain who, with Charles Levine, flew to Germany one month after the Lindbergh flight, probably received more publicity than the other flyers of his time but he never for one moment was a serious candidate for public hero worship. There was a momentary flurry that soon died out. Richard Byrd, he of antarctic fame, flew across one short month after Lindbergh, missing the shore by a distance easily measured in feet. And so on, throughout the list.

As we said before, this comment is being written with all the best intentions possible, so far as Colonel Lindbergh is concerned. We most certainly do not wish to cast a slur upon his great accomplishment, but we do wish to call the attention of the public to the fact that the real pioneers—the men who first crossed the briny—are not receiving the attention that is properly theirs. Our only wish is, therefore, that the names of Read, Brown, Alcock and Scott be as deeply engraved upon the hearts of the public as the name of Lindbergh.

END.

Photography

(*Continued from page 20*)

multi-lensed camera when flying, for instance, at an elevation of twenty-five thousand feet, the area covered will be approximately 25.9 miles wide.

With the multi-lensed cameras there are, of course, five rolls of film permitting two hundred exposures. When each film has been developed and matched, in relation to the center negative, the result will be a sort of a five-pointed maltese cross as shown in accompanying illustration, which is one of the pictures taken by Captain Goddard on the Alaskan Project, surveyed for the government in July, 1934, flying from an altitude of sixteen thousand feet.

In order to get an even more perfect and complete picture, the white spaces shown between the arms of the maltese cross will also be photographed.

To do this, a four-lens camera is mounted to the rear of the five lenses, one at an oblique angle, so that its lenses catch the area missed by the camera ahead.

This is known as a "tandem-mount" or "nine lens exposure," as all lenses are exposed simultaneously. The matching of the resulting negatives is a problem of extreme nicety.

There is no telling what the future will bring about in the development of the "Eyes of the army," but there are indications that, as business picks up, aerial photography will be increasingly used for commercial purposes, and we may expect "trick picture" combinations of aerial and ground shots to be used as advertising illustrations as has already been done in isolated instances.

POPULAR AVIATION has its ear, or should we say eye, not only to the ground but to several thousand feet above it, waiting and watching for developments in this field which as soon as released or discovered, will be passed along to its readers.

END.

MODEL THE ARUP

NOW you can build a flying model of the ARUP low aspect ratio plane with this complete ¾ inch scale kit containing a fully finished 7 inch hardwood prop, celluloid motor, turned balsa "balloon" wheels and all necessary material, cement, dope, etc., with a full-sized 3-view drawing. Complete Arup kit $1.50 postpaid U. S. A.

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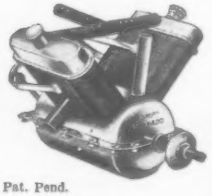

Pat. Pend.

TORNADO MOTOR

An Entirely New, Practical and Low Cost Power Plant for Models

You can build it into the nose of any type model; the one you have now or a new one; entirely out of sight. It will swing large propellers at high speed for long flights. Easy starting, no stalling, costs hardly anything to operate. Runs on AC:CO Gas, generated in the "IMP" Generator; a new invention that will revolutionize model flying. Will also run on compressed air.

New Power for Boats. Equally efficient as a power plant for Model Boats up to 36 in size, with IMP drive shaft, propeller, etc.

Model V-4 (shown above) four cylinder. Weight only 3½ oz. Will fly models from 4 to 8 feet. Complete with Generator, Feed Line and Safety Clip.... $7.50

Model S-2, two cylinder. Weighs 2½ oz. Flies models 3 to 6 ft. Complete with Generator, Feed Line and Safety Clip..... $5.00

(If ordered by mail, add 25c for postage)

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INTERNATIONAL MODELS COMPANY
1785 Broadway, General Motors Bldg., New York

FREE! WITH ORDERS OF $1 OR MORE — 1 DOZ. SHEETS JAP TISSUE or MODEL BUILDER'S KNIFE

Take advantage of this special FREE offer now! Experience what a real pleasure it is to do business with a model airplane supply house that keeps promises! Every order is shipped same day received! All materials are of highest quality! Prove this to yourself! Learn why so many builders, dealers and clubs deal with SKYWAY! Dealers! Send for prices on Balsa wheels with Brass Bearings

18" BALSA SHEETS
1/32x2, 5 for 5c..10 for 10c
1/16x2, 5 for 8c..10 for 12c
3/32x2, 3 for 5c.. 7 for 10c
⅛x2, 1 for 2c.... 6 for 8c
3/16x2, 1 for 3c.. 3 for 7c
¼x2, 1 for 4c.... 3 for 9c
½x2, 1 for 8c.... 3 for 14c

BALSA PROP BLOCKS
¼x⅜x6, 1 for 1c..6 for 5c
½x¾x5, 1 for 1c..5 for 5c
⅝x1x8, 1 for 2c..3 for 5c
¾x1x8 .....2 for 5c
¾x1¼x12, 1 for 3c 2 for 6c
1x1½x12 .....2 for 11c
1x1½x15 .....1 for 7c

18" BALSA LENGTHS
1/16x1/16 .....85 for 5c
1/16x⅛ .....40 for 5c
1/16x3/16 .....20 for 5c
1/16x¼ .....18 for 5c
3/32x3/32 .....35 for 5c
⅛x⅛ .....30 for 5c
¼x¼ ..... 6 for 5c
¼x½ ..... 4 for 5c
½x½ ..... 2 for 5c

18" BALSA PLANKS
1x1, 2 for..... 9c
1x2, 1 for..... 9c
2x2, 1 for.....16c
2x3, 1 for.....20c
2x6, 1 for.....35c

For 36" lengths double above prices and add 10c postage

Bamboo
1/16x12, 40 for 5c
1/16x¼x15 ..... 6 for 5c
Shredded..40, 5c
Japanese Tissue
All colors,
Doz. 10c
Thinner Best
1 oz. 5c

Sheet Celluloid
2x6 ..... 2c
6x8 ..... 4c
12x16 .....15c

Clear Dope
1 oz. 5c
½ pt. 25c

Colored Dope
1 oz. 5c
½ pt. 30c

Clear Cement
1 oz. 5c
½ pt. 30c

Wood Veneer
20x30", 1 for. 9c
2 for 17c

Reed
1/32, 1/16, ⅛
.....3 ft. 1c

Wooden Wheels
½", pair 2c
⅝", pair 3c
1", pair 4c
1⅜", pair 5c
1¾", pair 8c

Celluloid Wheels
⅜", pair 5c
1", pair 7c
1⅜", pair 9c
1⅞", pair 15c

Balsa Balloon Wheels
½" ....pr. 2c
⅝" ....pr. 3c
1" ....pr. 4c
1⅜" ....pr. 6c
2" ....pr. 8c
3" ....pr. 15c

THRUST BEARINGS 1c
BRUSHES, No. 0..5c
MODEL PINS, Lge. & Sml..5c pkg.
BUSHINGS, doz. 3c
PROP. SHAFTS, 2 for 1c

PAUL-O-WINA JAP PROPS
5" 10c
(add 5c per inch for props up to 10".)

Machine Props
5" 4c
(add 1c per in. for props up to 16".)

Rubber Motors
1/16 sq..20 ft. 5c
⅛ flat ..20 ft. 5c

INSIGNIAS—
French, American, English, German
1¼"...4 for 3c
2" 1c
1 sheet of 24, 5c

Dummy Radial Engines
1½" Diam...15c
1⅝" Diam...20c
3" Diam....25c
DOWELS, 1/6x12, ...10c per doz.

PLANS
20" Plans, ea. 10c
3 for 25c
Waco Biplane,
Texaco Sky Chief, Spad Chasseur, Sparrow Hawk, Vought Corsair, Douglas Dolphin Amphibian, Twin Skyfiler, Sky Cloudster, Curtiss Goshawk, Swift Curtiss

WASHERS, ⅛ and ⅛ .....doz. 1c
SANDPAPER, package 5c
WIRE, 6 ft...3c
36" lengths.
ALUM. LEAF, 2 sheets for 1c
NOSE PLUGS, large..10c doz. small...5c doz.

Send 3c stamp for "Helpful Hints for Model Builders" and catalog for other bargains. FREE with all orders. ORDERS 75c or under 15c postage. Postage prepaid on orders over 75c. West of Mississippi add 10c extra. Canada add 15% extra. CASH OR MONEY ORDER—NO STAMPS. NO C. O. D's.

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BEST QUALITY — LOWEST PRICES — SUPPLIES — KITS — ACCESSORIES

DIAMOND SUPPLIES for DEALERS

If 18" lengths are desired, take ½ of 36" length price.

If 3" widths are desired, double price of 2" widths sheet Balsa.

Thinner same price as clear dope.

BALSA STRIPS 36" Lengths

	Per 100
1/32x1/16	12c
1/16x1/16	14c
1/16x⅛	20c
1/16x3/16	25c
1/16x¼	27c
3/32x3/32	25c
⅛x⅛	30c
⅛x3/16	50c
⅛x¼	55c
⅛x⅜	85c
3/16x3/16	50c
3/16x¼	80c
¼x¼	85c
¼x⅜	$1.25
¼x½	1.60
⅜x⅜	1.90
½x½	2.25

BALSA SHEETS 36" Lengths

1/64x2, 10 for	14c
1/32x2, 10 for	15c
1/16x2, 10 for	18c
3/32x2, 10 for	21c
⅛x2, 10 for	23c
3/16x2, 10 for	32c
¼x2, 10 for	42c
½x2, 10 for	75c

BALSA PLANKS 36" Lengths

1x1, each	6c
1x1½, each	8c
1x2, each	15c
1x3, each	20c
1x6, each	35c
1½x1½, each	25c
2x2, each	25c
2x3, each	35c
2x4, each	45c
2x6, each	60c
3x6, each	$1.25

STANDARD PITCH BALSA PROPELLER BLOCKS Per Dozen

⅜x½x5	5c
½x⅝x5	5c
½x¾x6	6c
⅝x1x7	14c
¾x1x8	18c
⅞x1x9	25c
¾x1¼x10	30c
¾x1¼x12	35c
1x1½x12	40c
1x1½x15	55c

BAMBOO

1/16 sq. x 14, 1 gross for . . .20c
1/16x¼x11, 1 doz. for 5c

REED

1/32 or 1/16 dia., 50 ft. for 18c
3/32 or ⅛ dia., 50 ft. for 20c

DOWELS

1/16 dia. x 12" per doz., 100 for 55c, 25 for 20c
¼" dia. x 36" per doz., 100 for $1.50, 25 for 45c
3/16 dia. x 36" per doz., 100 for $2.25, 25 for 75c

COLORLESS CEMENT

1-oz. bottles, per doz.	23c
2-oz. bottles, per doz.	40c
4-oz. bottles, per doz.	70c
1 pt., each	45c
1 qt., each	75c
1 gallon, each	$2.00

NOSE PLUGS, HARDWOOD

Per doz. 5c
100 . . . . . 40c

BIRCH WHEELS LIGHT AND STRONG

½"	per doz. 5c
⅝"	per doz. 6c
1"	per doz. 8c
1¼"	per doz. 10c
1½"	per doz. 18c

WIRE, STRAIGHT LENGTHS

Nos. 5, 6, 7, 8, 9, 10, 11, 12, 14, 15 or 16, 100 ft., ass't sizes 25c

THRUST BEARINGS

Small or large, each 2c
Per doz., 18c; per gross . . . 75c

MODEL PINS

Per doz. pkgs. 35c

SANDPAPER

Per doz. pkgs. 25c

WASHERS

⅛ or ¼ dia., 1 gross 10c

3" DIA. CELLULOID MOTOR AND DRAG RING COMBINED

(First time on market)
Special price, 3 for 75c

DUMMY RADIAL ENGINES

(Celluloid, 9 cylinders)

1⅛" dia., ½ doz. for	60c
2" dia., 3 for	65c
3" dia., 3 for	85c

CELLULOID PANTS

For ⅝" or 1" wheels, ½ doz. 50c
For 1⅜" or 1⅝" wheels, ½ doz. 75c

¾ FINISHED BALSA WHEEL PANTS

Ready for final sanding
To fit:

½" wheels	6 pr. 36c
⅝" wheels	6 pr. 36c
1" wheels	6 pr. 36c
1⅜" wheels	6 pr. 54c
1½" wheels	6 pr. 54c

BRASS BUSHINGS OR EYELETS

1/16 diam.	per 100 . . 12c
3/32 diam.	per 100 . . 15c
⅛ diam.	per 100 . . 18c

CELLULOID WHEELS

⅝" dia., pr., per doz.	24c
1" dia., pr., per doz.	25c
1⅜" dia., pr., per doz.	35c
1⅝" dia., pr., per doz.	60c

COLORED DOPE

White, yellow, orange, blue, red, green, olive drab, black, silver, gold or grey.

1-oz. bottles, per ½ doz.	25c
2-oz. bottles, per ½ doz.	50c
4-oz. bottles, ½ doz.	$1.00
1 pt., each	50c
1 qt., each	85c
1 gallon, each	$2.25

HIGH-GLOSS

To shine up colored models.

1-oz. bottles, per ½ doz.	30c
2-oz. bottles, per ½ doz.	55c
4-oz. bottles, ½ doz.	$1.00

WOOD VENEER

(For scale model work)
20"x30", 3 sheets for 25c

JAPANESE TISSUE

White, per doz.	12c
Colored, asst., per doz.	15c
All colors.	
Silver, per doz.	21c

PROP SHAFTS (Hard Steel)

One size fits all models

Per dozen	10c
Per gross	75c

REAR HOOKS (Hard Steel)

One size fits all models

Per dozen	10c
Per gross	75c

CLEAR DOPE OR BANANA OIL

1-oz. bots. ½ doz.	23c
2-oz. bots. ½ doz.	40c
4-oz. bots. ½ doz.	70c
1 pt., each	40c
1 qt., each	65c
1 gal., each	$1.75

SHEET CELLULOID (Transparent)

12½x16, each	19c
6x8, doz.	65c

FRESH PARA RUBBER AAA GRADE

Per 225' skein

1/32 sq.	25c
.045 sq.	35c
3/32 flat	35c
⅛ flat	40c
3/16 flat	70c
Lb., any size	$1.25

INSIGNIA SHEET

12 pr. & rudder and tail markings with gummed back.
Doz., 36c; 100, $1.75

BALSA BALLOON WHEELS (Machine turned)

½" dia., per doz.	8c
⅝" dia., per doz.	11c
1" dia., per doz.	14c
1⅜" dia., per doz.	19c
1⅝" dia., per doz.	38c
3" dia., per doz.	85c

SHEET ALUMINUM

.002 thick, 5 ft. for	35c
.005 thick, 5 ft. for	50c
.010 thick, 5 ft. for	75c

ALUMINUM LEAF

.0003 of an inch thick, 3½" wide, 100 ft. for 35c

ALUMINUM TUBING (Special 1/100" wall)

1/16 O. D., 5 ft.	30c
3/32 O. D., 5 ft.	32c
⅛ O. D., 5 ft.	32c
3/16 O. D., 5 ft.	40c
¼ O. D., 5 ft.	45c

ACCESSORIES Aluminum Cowls

Anti-drag rings, closed N.A.C.A. or open N.A.C.A.

1½", 3 for	25c
2", 3 for	35c
2½", 3 for	45c
3", 3 for	55c

Die-cast Bombs

¾" long, 3 for	8c
1½" long, 3 for	15c
3" long, 3 for	30c

2-bladed Props (Die Cast)

1½" long, 3 for	18c
2½" long, 3 for	28c
3½" long, 3 for	40c
4½" long, 3 for	50c

3-bladed Props (Die Cast)

1½" long, 3 for	20c
2½" long, 3 for	30c
3½" long, 3 for	45c
4½" long, 3 for	55c

Pursuit or Swivel Machine Guns (Die Cast)

¾" long, 3 for	7c
1" long, 3 for	15c
1¾" long, 3 for	25c

Die-cast Wing and Tail Lights, 3 Pcs. to a Set

For 12" model, 3 sets	15c
For 15" model, 3 sets	20c
For 24" model, 3 sets	35c

Carved Props

5", per doz.	24c
6", per doz.	28c
7", per doz.	35c
8", per doz.	40c
10", per doz.	50c
12", per doz.	60c

Get ready for the big Christmas rush—stock up on Diamond supplies . . . place your order now while we can still satisfy the demand at our rock-bottom prices and give 48 hour service. DIAMOND supplies are fully guaranteed to give entire satisfaction or money back—no splits . . . only first hand picked selected supplies . . . that's why we are headquarters for quality . . . we charge no more than you pay for ordinary grades . . . try us.

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A 36" flying model . . . movable cockpit control . . . simplified plans and all supplies. DEALERS WRITE FOR QUANTITY DISCOUNTS. **$1.50**

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SALE! ORDER NOW! WHILE SALE LASTS . .

5 inch Solid Kits, $4.10 Gross—5" solid model Kits, complete with all parts printed, full size plan, insignia sheet, cement, and sandpaper sell very nicely at any price up to 10c. Choice of Boeing P-12F, Texaco Sky Chief, Spad, Fokker D-VII, Lockheed Vega or S.E.5, 50c per doz., $4.10 gross.

2 in 1 Kit—15" Flying Scale Models of Fokker D-VII and Curtiss Robin in one box with large quantities of materials, complete with carved prop, wire parts bent, full-size plan and instructions, printed sheet, large bottles of cement and dope. Boys order these kits again and again. 3 for $1.00; 12 for $3.80.

FREE WITH EVERY $5 ORDER 1 DOZ. INSIGNIA SHEETS Retail Price, $1.20

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